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FOR

AMATEURS.

BY

T. C. HEPWORTH, F.C.S.,

EDITOR OF "THE PHOTOGRAPHIC NEWS."

Eighth Edition.

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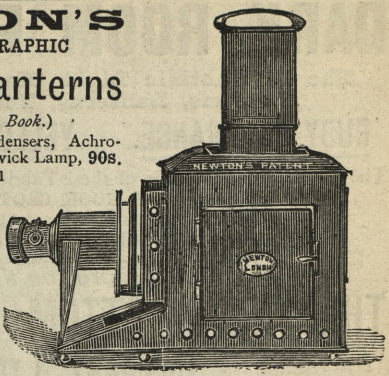

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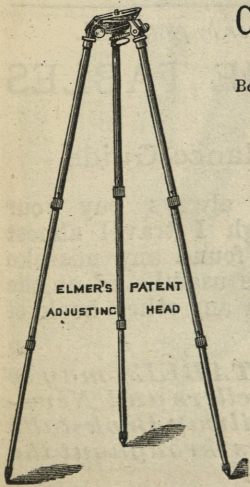

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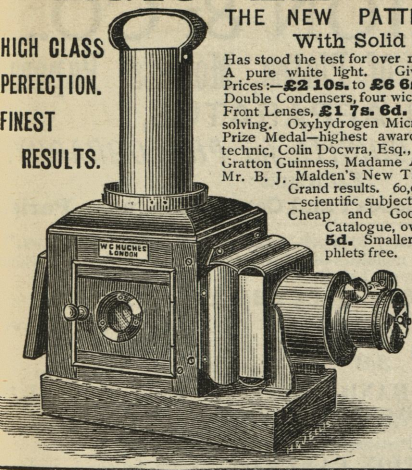

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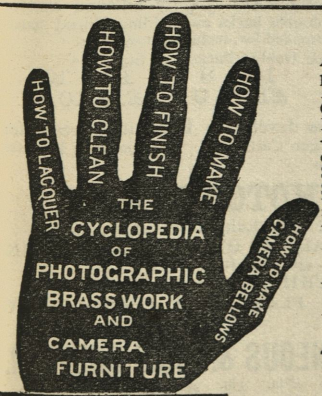

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A Non-Technical Manual for the Use of All.

BY

T. C. HEPWORTH, F.C.S.,

EDITOR OF "THE PHOTOGRAPHIC NEWS."

EIGHTH EDITION.

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CASSELL & COMPANY, LIMITED:

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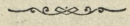
1892.

PREFACE.



The object in offering to public notice this brief Manual of Modern Photography, is to provide a practical guide for the use of the many amateur workers who, since the introduction of gelatine dry plates, have taken up the art as a pleasant occupation for their leisure hours. That some such guide was wanted will be evident when it is considered how many there are who wish to be able to take photographs, and yet have not the time to take up a subject which is popularly believed to bristle with all kinds of difficulty, and to require some knowledge of the mysteries of chemistry. That such a knowledge is necessary to the experimental worker must at once be admitted, but there are thousands of persons who simply require to know how to produce a passable picture. There are, too, many artists who are beginning to learn the value of the camera as an aid to correct sketching. With it they can secure details of a picture with marvellous accuracy almost instantaneously, which attempted with the pencil alone would occupy many hours of labour. But a busy artist could never

afford the time to master the details of photography unless the operations could be quickly learnt, and readily applied to his every-day work. I trust that my little book will be of service to the artist, as well as to his non-professional brothers and sisters. Thanks to the cleanliness of modern photographic operations, ladies can and do include the art among their other accomplishments.

T. C. HEPWORTH.

45, *St. Augustine's Road,*
Camden Square, London, N.W.,
March, 1886.

CONTENTS.

PHOTOGRAPHY FOR AMATEURS.

CHAPTER I.

INTRODUCTION.

THE history of the art of Photography is the record of the patient labours of many different men—who, many of them unconsciously, were making the bricks for a structure which was some day to reach the most surprising dimensions. In endeavouring to trace this history, the inquirer will speedily notice that it tells of two distinct armies of busy workers, one of which devoted itself to the optical part of the art, and the other to the chemical part. The first contributor to the optics of photography was a clever Neapolitan philosopher, who flourished in the second half of the sixteenth century. His name was Baptista Porta.

Baptista Porta was the inventor of the contrivance known as the camera obscura, which, in its first form, no doubt, merely consisted of a darkened room, with a white screen inside, upon which the image of the outer landscape was projected through a small hole in the shutter. That such a simple arrangement will produce an image may be very easily proved by any one who cares to do so. A box may do duty for the dark room, and the image, projected through a

tiny hole pierced in the bottom, may be plainly seen if a piece of tissue-paper or ground glass be placed across the opening of the box for its reception. In its more elaborate and modern form, the camera obscura usually consists of a dark room or tent, about ten feet in diameter, and with a dome-shaped roof. At the top of this dome there is an opening, furnished with a lens and a sloping mirror above it—a mirror which, turning on an axis, can be made to face any portion of the surrounding country. The image, by means of this mirror, is reflected downwards through the lens upon a whitened table below, on which the landscape appears in all its natural colours. Sometimes a prism is made to do duty for both lens and mirror.

Although the camera obscura may be said to have had its day—for we now meet with it only occasionally at some show place, as the Crystal Palace—it was once in far greater use. Country houses, before they were brought by means of the railways within a few minutes' journey of our large cities, were often provided with a camera obscura as a means of amusing their inmates. But the instrument, in the portable form of a tent, became a great favourite with artists as a help to them in sketching from nature. A tent, with its mirror and lens, and a folding table, upon which could be spread a sheet of drawing paper, did not present a very heavy burden, and the artist could quickly trace on the paper with his pencil the exact outline of every image cast upon the paper by the lens above.

Among the artists who availed themselves of this

help was Daguerre. He aimed at getting telling effects in a rapid manner, and the camera obscura was just the thing to be of use to him. In the year 1820, Daguerre had already become famous in Paris as a scene painter at the Opera-house, for he produced effects of light and colour that had never before been seen in a theatre. A few years later the people of the gay capital were flocking to see his wonderful diorama, and trying to guess how the marvels which they saw were accomplished. There is no doubt that the constantly changing views of the camera obscura, to which Daguerre had accustomed his eyes, had much to do with his success as a scene painter. But his labours with that instrument were destined to accomplish a far greater work than the mere passing amusement of the gay Parisians. They were gradually laying the foundation of the art of photography which can only be looked upon as one of the grandest discoveries of the century.

While Daguerre was dreaming of some means by which he might succeed in making the evanescent pictures of the camera obscura permanent, there was another earnest worker in the same field, who, quite unknown to Daguerre, was making some noteworthy experiments at Châlons-sur-Sâone. Nicéphore Niepce was one of two brothers, who, besides contriving many useful models of various machines, had devoted much time to the phenomena of the camera obscura. One brother had at this time come to London, but Nicéphore remained at Châlons, and to him only it will be necessary here to refer. He was first of all attracted

to the then new art of lithography, and in the constant endeavour to produce like effects by the aid of the camera, he made a remarkable discovery. He found that when bitumen of Judea was exposed to the action of light, it became insoluble in the usual menstrua; so that by placing a drawing or engraving, previously varnished to make it transparent—over a metal plate covered with a thin layer of bitumen, and exposing the whole to the sun, those parts of the bitumen unprotected by the lines of the drawing could afterwards be dissolved out by a bath of essence of lavender. By placing such a plate in a camera, the light from the lens had a similar effect, and a veritable photograph, such as it was, was obtained.

These experiments are now but of historical interest. Niepce's pictures on metal plates were but crude productions, for the bitumen employed is so very slowly acted upon by light that a picture under favourable circumstances occupied several hours in its production, during which the lights and shadows of the subject changed their positions so much, that a foggy and ill-defined result was inevitable. One valuable process, however, resulted from these experiments. Taking a metal plate, upon which one of these bituminous pictures rested, Niepce showed that it was possible by means of acid to etch away those portions of the metal not protected by the bitumen, and afterwards to use the plate in a printing-press. This is the foundation of that beautiful method of producing pictures which comes under the head of Heliography.

Eventually Niepce and Daguerre met, and after some little time they proposed, as both were engaged in the same kind of research, to enter into a sort of partnership, and to acquaint each other with their methods of working. But nothing came of this arrangement, and both apparently were content to work independently. Daguerre continued to give his mind to chemistry, trying compound after compound without any definite success, until one of those strange accidents which will sometimes occur just in the nick of time gave to Daguerre a hint which quickly led him to the goal of which he was in search. Upon a silver plate which he had treated with iodine he had carelessly left a metal spoon. Upon raising that spoon some time afterwards, he found its image clearly impressed upon the plate. From this he learnt that iodide of silver was sensitive to light, and after a few more experiments the so-called Daguerreotype was introduced. In this process, a silvered plate, treated with iodine, is exposed to the action of light in the camera, and is afterwards developed by the fumes of mercury. Almost at the moment that success was achieved Niepce died.

Whilst these events were occurring in France, there were in England some interesting experiments going forward which had almost as much to do with the birth of photography. We have seen that the first contribution to the optical part of the science was Baptista Porta's camera obscura, in the sixteenth century. About the same period it had been found out that white chloride of silver would darken if

exposed to light. This one little fact was the only bit of photographic chemistry known for two hundred years, when we find Scheele, the Swedish chemist, experimenting with chloride of silver, and producing a rough picture by its aid. He covered a flat surface with the compound, and by means of a strong light cast the shadow of a person's profile upon it, with the result that all those portions of the surface not protected by the shadow turned black, the rest remaining white.

Scheele was also the first to point out that the yellow and red rays of the solar spectrum had little or no effect upon this compound of silver, sensitive to ordinary light. Wedgwood, in 1802, took up the thread dropped by Scheele, and in the course of a paper contributed to the Royal Society, described a new method of copying pictures. Paper, dried after immersion in a solution of common salt (chloride of sodium), is brushed over with a solution of nitrate of silver, with the result that a sensitive surface of chloride of silver is formed on the paper. By placing over such a surface fern-leaves, pieces of lace, &c., and exposing them to sunlight, Wedgwood produced a variety of pictures, such as Scheele had done before him—white on a dark ground. But he did not succeed in making these pictures permanent. Unless kept in the dark, the white portions, under the action of diffused light, slowly became blackened, until nothing worthy of the name of a picture remained. It was not until many years after that Herschel, the great astronomer, pointed out hypo-

sulphite of soda as a fixing agent, and as such it is used to the present day.

In 1839 Daguerre gave his invention publicity; but Fox Talbot, in England, had before that year been experimenting in the direction of obtaining pictures on paper. Repeating the experiments of Wedgwood, he succeeded, by means of his camera, in producing pictures of external objects by long exposure of the prepared paper to the action of the lens. He has left a curious and interesting account of the manner in which he placed roughly-contrived cameras all round his house in the summer of 1835, and obtained successful pictures thereby. He naïvely says: "To the traveller in distant lands who is ignorant, as too many unfortunately are, of the art of drawing, this little invention may prove of real service." Later on, by means of iodised paper treated with silver, Fox Talbot introduced a really serviceable process. The paper pictures so produced he called negatives, for the lights and shadows were all reversed. To obtain a positive picture in sunlight, he placed prepared paper beneath the negative, so that those portions beneath the clear portions of the negative were darkened, and those beneath the opaque parts remained white, for the light could not get to them. He thus obtained exactly the reverse effect from a superimposed negative. These terms negative and positive were first used in connection with photography by Talbot, and they retain the same meaning now as then.

Passing over many minor inventions, we reach the year 1851, when a most important improvement

in photography was announced by Scott Archer, which, under the name of "Wet Collodion Process," has produced the perfect pictures to which we have been accustomed in modern times. In this process glass is employed as a basis for the future picture. It is first of all covered with a varnish-like compound, called collodion. This is a solution of gun-cotton in ether and alcohol, which, for photographic purposes, is charged with certain iodides and bromides. The glass thus collodionised is dipped for several seconds in a bath of nitrate of silver, so as to allow the dissolved iodide and bromide in the collodion to form iodide and bromide of silver, and thus present a surface highly sensitive to light. In this state the glass plate is transferred to the camera, and by exposure to light a negative invisible picture is produced, which is afterwards rendered visible by development with a solution of an iron salt.

Such, briefly, is the wet collodion process of Archer, which for more than thirty years has been the sheet anchor, so to speak, of the professional photographer, and which only lately has been partly superseded by a more convenient method. With all its advantages, the wet process suffered from one or two serious drawbacks, which almost restricted its use to the professional man, whose business it was to make the best of them. But many amateur workers arose, who, luckily for the art, had money and time to experiment—who thought that a means could be found for producing plates and using them dry. (In the wet process the plates

must be used at the time they are prepared, or they are worthless.) Such a plate would, they argued, do away with the mess and stained fingers inseparable from the use of a bath of nitrate of silver, and would be a great boon to those who, travelling in foreign lands, could only, with the old process, produce photographic pictures under the penalty of being accompanied in their journeys with a movable chemical laboratory. With this idea dry processes were one after the other invented. Some of these gave very beautiful results, but yet not good enough to tempt the professional photographer from his old groove. At last one or two enthusiastic amateurs began to tell of the wonderful pictures obtainable by using gelatine as a medium for holding the sensitive salts; and when, shortly afterwards, pictures taken by the new method were exhibited, the professional photographers suddenly awoke to the advantages it offered, and the old wet process found a formidable rival before it.

In the gelatine process, the sensitive salts (such as the bromide and iodide of silver) are mixed with warm solution of gelatine, and spread upon plates of glass. When dry, the plates are ready for putting into the camera, or they will keep indefinitely. It is at this point in the history of photography that it is intended in this little book to take the matter up practically. Although, as I have pointed out, the art is indebted to amateur workers for its most recent improvements —as, indeed, it has been indebted to them for many past discoveries—it was not until the introduction of

dry plates that photography could be conveniently practised as a pastime by amateurs generally. Many of those who did dabble in it speedily became disgusted with the constant mess, trouble, and expense which it entailed. But now all is different. The tourist can carry in a knapsack all that is required for outdoor work, and can postpone the operation of developing his pictures, in which bottles and dishes necessarily come into play, until the end of his travels, and when he is again at home.

A few brief notes dealing with the history of the gelatine process may be found interesting. In the year 1871, Mr. R. L. Maddox produced some very beautiful pictures by means of gelatine emulsion. A great many amateurs worked in the same direction, but on all hands the process was considered a slow one—much slower, indeed, than collodion emulsion, which was then the most favoured dry plate method in use. Soon afterwards Mr. R. Kennett began the manufacture of gelatine plates commercially, and it is a significant fact that he had to adopt precautions to keep them slower than they naturally were, so unused were operators to anything quicker than the old wet collodion process. Suddenly Mr. Charles Bennett published an article, in which he gave details for making very quick emulsion: the secret in the matter consisting of the simple process of slowly ripening the finished emulsion at a gentle heat for several days—the longer the period, within certain limits, the more rapid the product. There are not a few plate-makers who still hold to this plan, and

assert that by it they gain a quality of plate not otherwise attainable.

The next advance was the publication of the circumstance that the same effect could be produced in a few hours by the simple expedient of boiling the emulsion; but whereas the heat would be certain to prevent the gelatine from properly setting when cold, a portion only of it is mixed with the silver and bromide, the greater proportion being added afterwards, when the emulsion is somewhat cooled. Other published formulæ take advantage of the fact that ammonia added to the emulsion also shortens the time of preparation, but in this case the heat must be limited to a much smaller amount, or general decomposition occurs.

CHAPTER II.

CHOICE OF APPARATUS.

It is a very difficult thing to advise an intending purchaser what to buy, and how to buy it, without having a preliminary peep into his purse, to see how much money he can devote to the purpose in hand. The old hackneyed directions which the writer of a book is almost forced to give must once more serve its purpose here. Go to a reputed maker, tell him how much you intend to spend, and be guided by his advice. The beginner must have certain apparatus to begin with, and the better and more complete the outfit, the more complete his work will be. But just to show what can be accomplished under difficulties by a determined man, I may state that a friend of mine, serving during the Zulu War in South Africa, brought home several photographs—and presentable ones, too—which had been taken with some hastily-made apparatus that had never seen the inside of an optician's warehouse. The camera was made out of a cigar-box, and the lens came from an old telescope.

Here is a list of the articles required for ordinary landscape photography, leaving out all mention of chemicals and appliances wanted in the after treatment of the plates.

A camera and lens.
A portable tripod stand.
A focussing cloth.
Some gelatine plates.
A red lamp.

The ingenuity which has been spent upon photographic apparatus, particularly since the introduction of gelatine plates, is very remarkable. It is a matter of no small interest to trace the progress which has been made from the first simple camera, like that shown in Fig. 1, where one box

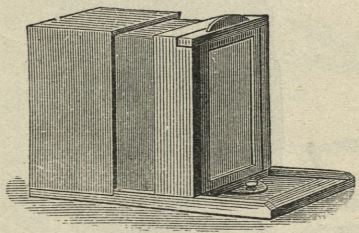


Fig. 1.—Simple Camera.

slides into another, and so enables the picture to be focussed, to the elaborate instruments of the present day, which fold up and pack into such a small space that they add little to a tourist's impedimenta. In order that this folding may be accomplished without difficulty, modern cameras are made with bellows bodies, just like an accordion, and pull out or shut in as may be required. This movement may be effected by a screw action with a handle at the back (as shown at Fig. 2), or by a rack and pinion arrangement, with a knob to turn at the side. It is as well to purchase a camera that will open out to a great extent, for it

may on some occasions be desirable to use a lens of great focal length. Sets of apparatus are now sold at various prices, which pack up in a leather case in the most compact manner, and can be carried with ease

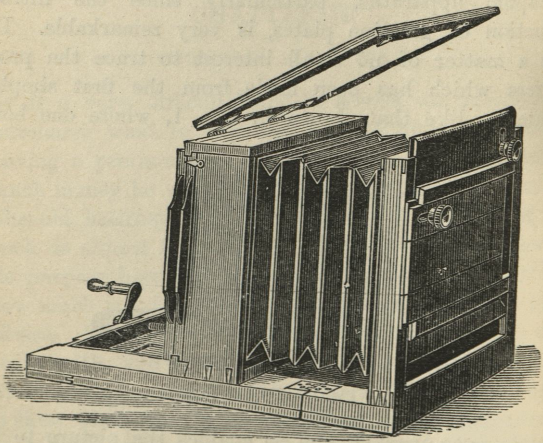


Fig. 2.—Folding Camera.

in one hand (*see* Fig. 3). Those who know what it was to work in the field with the old wet plate process, with its bottles of chemicals and dark tent and mass of luggage, that fully burdened two men at least, are apt to exclaim at the advantages which the gelatine worker possesses, in being quite independent of anything but what his own hands can carry.

Whatever be the exact form of the camera, it must possess a screen of ground glass at the back, upon which the image formed by the lens is received.

In the majority of cameras this screen is hinged so that it can, as depicted in Fig. 2, be folded over the top of the instrument when the picture has once been

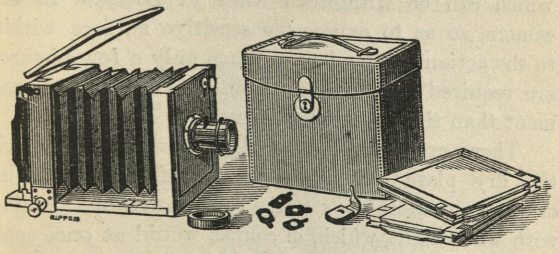


Fig. 3.—Tourist's Photographic Set.

focussed. It is necessary to get it out of the way, for the exact place which it formerly occupied must be taken by the sensitive gelatine plate, upon which the same image which just now fell on the ground glass is destined to impress itself. The most common method of conveying a gelatine plate to the camera, for the purpose of taking a picture, is by what is called a dark slide. These slides are now made double, so as to contain two plates each, and three of these double slides are commonly supplied with every camera. Supposing that we wished to take a couple of views only, we should take up the slide marked 1 and 2 on each side respectively. Then having focussed the first view, the ground glass screen would be folded back, and the slide would be put in its place, where there is a groove to receive it. The slide marked 1 would be made to face the

lens. Then when the next view is taken the slide is simply turned round, so that No. 2 faces the lens. Each side of the slide has its own shutter, which can be withdrawn when in position in the camera, so as to expose the sensitive surface within to the action of the lens. When only a few pictures are required to be taken, there is no better arrangement than this of double slides.

There are several other plans, however, by which the dry plate can safely be transferred from its original containing box to the camera without meeting with white light, which, of course, would at once spoil it. Here is the picture of a changing box which I have used for several years, and would not willingly part with. (*See* Fig. 4). The way it works is as follows:

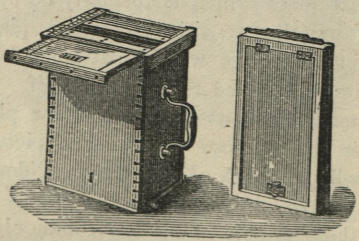


Fig. 4.—Changing box.

Before leaving home on a photographic tramp, I take the box into my dark room, unlock it, remove the sliding bottom, and carefully dust out its interior. Here I see twelve grooves, which I proceed to fill with gelatine plates—a plate in each, and all facing one way. The box is then locked, and I am ready for

work. A special dark slide is used with this box—a slide which fits into a groove upon its top surface. As soon as the slide is adjusted on the box—which is the work of a moment—communication between

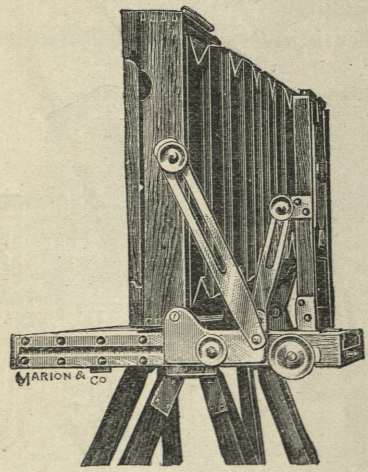


Fig. 5.—Improved Camera.

the two is automatically opened; the box is inverted, and you hear the gelatine plate drop from No. 1 groove into the attached slide. You then take your picture, and return the plate to its old position. By shifting a simple sliding arrangement attached to the box, you can severally expose the whole of the twelve plates. The entire contrivance works most perfectly.

Of late manufacturers of cameras have vied with each other in producing instruments of the lightest possible build, such as that shown at Fig. 5. In these cameras both back and front are made to shift to and fro, an arrangement which is useful in certain contingencies.

Another ingenious and lately-introduced method

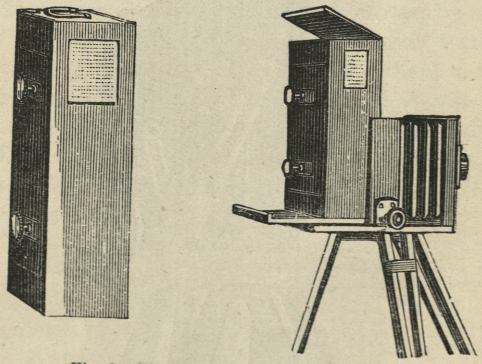


Fig. 6.—The Multiplex Camera and Back.

of changing plates in the field is the multiplex back represented at Fig. 6. On the left-hand side is seen the multiplex alone; on the right it is shown attached to a camera—taking the place, in fact, of the usual dark slide—with its shutter upraised ready for action. In a larger cut (Fig. 7) is shown in detail the way in which the thirteen plates which the apparatus holds are disposed. There are, to begin with, thirteen loose wooden frames, each furnished with a

japanned metal screen, and buttons for fastening a gelatine plate in front of that screen. These frames

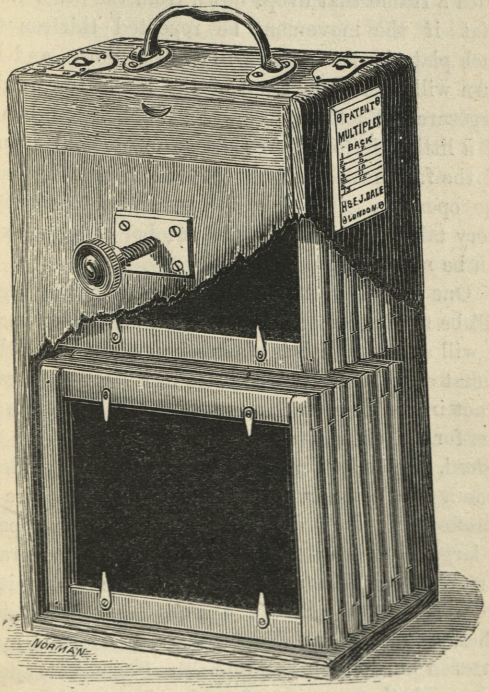


Fig. 7.—Section of Multiplex Back.

are arranged in two separate tiers, as shown. One tier will be occupied with seven plates and the other with six, there being room in the latter for one more.

If now the operator turns the box completely over, the blank space in the one tier is immediately filled with a frame that drops down from the other tier; so that if the movement be repeated thirteen times, each plate in succession will so drop down, and in its turn will be in the front of the lower tier ready for exposure. Each frame bears a number, and by means of a little window of red glass the particular number of the frame next the shutter can always be seen by the operator. The box is further provided with an ivory tablet, upon which the number of plate exposed can be marked in pencil.

One of the first considerations with the beginner will be the choice of the particular-sized picture which he will adopt. This is a more important point than it at first sight seems. The price of a large-sized camera is not in itself so much more than the price of a small one, for the cabinet-work in each is much the same. Indeed, we might almost say that the smaller the camera the better workmanship it will require; and therefore its price is necessarily brought near apparatus of larger kind. But the price of a lens rapidly increases with the size of the picture which it will give. Then the price of the plates, the developing dishes, and the chemicals required also becomes an increased burden when a large-sized camera is adopted. In a word, the expense of taking large pictures, from their first impression in the camera to the final operation of printing them, is very great. As a case in point, let us see the number of prints obtainable from a single sheet of sensitive paper. If we are content

with *carte* pictures, we can manage to cut forty-two from the sheet; but if we aspire to 10×8 pictures, we shall only get four. I believe that one of the best sizes to begin upon is 5×4 inches. This will give a compact camera, and double slides or changing box, which can be easily carried without fatigue. I have been in the habit of carrying a $7\frac{1}{4} \times 4\frac{1}{2}$ camera, which, with its accessories, is certainly rather heavy for a ten or fifteen miles walk. For this reason I am now putting it aside for a smaller apparatus. There is one more consideration to urge in this connection: small pictures can always be enlarged, and the means of doing so are well within the capabilities of an amateur worker, as I shall endeavour to point out in another chapter.

With regard to the lens to be employed, a few words are necessary. If the amateur intends to confine himself to landscape, with an occasional attempt at portraiture, he can get on very well with a cheap single lens. This simple lens has many advantages; but it has the drawback of bending straight lines, and therefore it cannot be used for architectural subjects: but, at any rate, the lens is a capital one for a learner. When he gets proficient in the work, and possibly compares notes with other amateurs whom he will meet at home and abroad, he will soon perceive that there are really only two descriptions of lenses used for out-door work. One is known as the "Rectilinear," and the other as the "Symmetrical." They are really very much alike in construction, and both give, as the name of the first

mentioned implies, perfectly straight lenses. In my own practice I carry a rapid "rectilinear" of about $6\frac{1}{2}$ inches focus, and a "portable symmetrical" of much shorter focus, both screwing into the same flange on my camera. If circumstances compel me to be so close to my subject that the image as formed by the first lens is much too large, I screw on the second one in its place, and take my picture with that.

Most beginners will be anxious to take what are called "instantaneous pictures," but they will be wise not to attempt them till they have mastered the simpler mysteries of the craft. Both lenses and plates are so rapid in their action now-a-days that there is no great difficulty in this branch of work when the amateur is really proficient with ordinary photography. It is seldom that an instantaneous view forms a really satisfactory picture. Rowing and yachting matches, and river and sea-scapes generally, form the best subjects for such work; but they require both skill and experience, as is evidenced, I think, by the really small number of such studies that have been published.

There are several capital forms of tripod-stand in the market, but some are better than others. The properties which a good stand should possess are lightness, compactness, absence of screws or other loose parts, and, most important of all, extreme rigidity. A rickety stand is an abomination, with which a good picture cannot be taken; and in cheap sets of apparatus the stand is generally the most faulty accessory. Some stands are firm enough; but

they require so much putting together and adjustment of screws that, by the time the camera is mounted, the object for which it was unpacked has disappeared.

I need not say much about the focussing-cloth. By all means have a good-sized one—say a yard and a half square. Some people rejoice in one made of velvet; but I have found one of a cheap material, called "Silesia," to answer every purpose. If it gets mislaid or lost, it need not be mourned over, as a more gorgeous velvet one might be. If the cloth be furnished with a few buttons on one edge, and some corresponding loops on the other, it can be fastened securely to the camera on a breezy day, when the wind threatens every minute to send it flying.

Of red lamps there are many patterns to choose from. For studio work, by all means have a paraffin one with a proper light-tight top and a red chimney, which can be further protected by screens of orange-paper. But for field-work, when the operator is travelling from place to place, and sleeping at hotels at night, where he will want to change plates, and perhaps to develop one occasionally, he will want something of a far more portable nature. There is nothing better than the lamp shown at Fig. 8, and it has the merit of being easily home-made. To make it, you must procure three pieces of stiff cardboard, each measuring 12 × 7 inches. In one of them cut a window. This

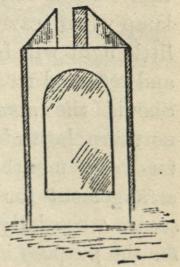


Fig. 8.—Cardboard Travelling Lamp.

window must be filled in with either ruby medium, or bookbinder's cloth of the same colour. (This material, by-the-bye, is most useful as a screen for photographic operations, two thicknesses over an ordinary window being ample protection.) Fix the medium to the card by means of thin glue, and hinge the three pieces of card together—the window one in the centre—by glueing strips of the medium over each join, both back and front. Before the glue is dry, see that the arrangement folds up perfectly flat. Then glue one more strip of the cloth over one side of the remaining join, so that when the whole arrangement is standing up, with a candle burning in the centre, no light will come through the open join at the back. A triangular piece of tin, with the corners cut off to give ventilation—which can be wrapped between the folds of the lamp when travelling—completes the contrivance. A little light will be emitted from the ventilation spaces and reflected from the ceiling; but this does no harm. Should the amateur photographer propose to visit northern latitudes, where the daylight is continuous for many months of the year, he will want another arrangement for changing his plates, unless he can secure a specially darkened room. What I recommend for the purpose is a dark tent with a red window in it to fit over the tripod-stand. This, without its camera, should be put on a table, and crowned with the tent. The operator can then put his head underneath, and work with comparative comfort.

Fig. 9 represents what is known as an "instantaneous shutter," of which many different forms are

now made. It is only used for taking pictures of moving objects, which must necessarily be done in a fraction of a second. It is usual to employ the full aperture of the lens for such pictures; but with *very* rapid plates the lens must be stopped down even in giving one of these short exposures. However, this perhaps would only be the case under the very best conditions of light. The most simple shutter is of the drop form: that is to say, a screen having an orifice in it falls either in front or behind the lens, and so allows the light to get in while the aperture is passing. The movement can be hastened by the use of an india-rubber band acting as a spring. I have already dissuaded beginners from taking rapid pictures among their first attempts. Still, they may occasionally come across subjects in which the use of a shutter is desirable. Waterfalls, ripples on water, breaking waves, &c., will form good objects for first practice. For two recent models of instantaneous shutters see pages 171 and 172.

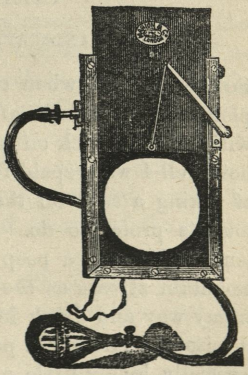


Fig. 9.—Instantaneous Shutter.

CHAPTER III.

LANDSCAPE PHOTOGRAPHY.

Some years ago, when on a walking tour in Scotland, plodding along mile after mile over hill and dale, with my knapsack on my back, I was pleased to find how well I was repaid for trusting to my legs instead of taking a seat on the top of a coach, which most tourists prefer to do. Instead of having to be content with a mere peep at some roadside cottage or mountain stream as the coach flew by, I could pause on my way and drink in all the beauties of the scene at leisure. Along the pass of the Trossachs I found especially lovely little nooks, which seemed never to have been trodden by human foot. I need hardly point out how valuable such picturesque "bits" are for the purposes of photography. So let me advise all who take up the camera as a pursuit to become tramps as well. They will get far more enjoyment from an outing, to say nothing of the accession of rude health. There is always an advantage, too, in having a purpose in view beyond mere pedestrian exercise. The gun or the fishing-rod fulfils this office for many, and sportsmen have the added gratification of killing something—a trait in the British character which seems to be inherited from our ancestral cave-dwellers. For my part, I think that the photo-

graphic camera is perhaps the best and most entertaining dumb companion a man can have. It certainly gives a very distinct object to an excursion. Like a living thing, it must be fed, but its food, instead of being costly to its owner, furnishes him with an intellectual feast of no mean character. The varied beauties of Nature are not merely scanned as they happen to present themselves, but are eagerly sought out. They are then studied, viewed from different points, until one or another aspect is selected. The camera is now brought into action, and if in the hands of an experienced man, the view is focussed on the ground glass, and the picture is taken in a minute or two.

The whole thing seems so ridiculously easy to an onlooker. The machine is set up on its three legs, covered with a black cloth, which presently also enwraps the operator's head. The head is next withdrawn, and its owner places his hand under the cloth to manipulate something or other; he then removes the cap from the lens for a second or two, and the picture is taken. The modest individual who, in answer to the question whether he could play the violin, replied that he did not know for he had never tried, would probably have given the same reply had the questioner asked him if he could take a photograph. It certainly looks as easy as violin playing, and, luckily for its votaries, it is a great deal more so. But for all this, let not the tyro imagine that because he has obtained the best and most costly apparatus that money can buy, that, as a matter of

course, he is at once to blossom out into a competent photographer. I know more than one fortunate possessor of such things who has never taken a presentable picture, and I don't believe ever will do so. They lack the patience and application necessary for the work, and, unfortunately, money will buy neither the one nor the other.

The success of a landscape photograph mainly depends upon the judgment with which the subject is chosen. The beginner will be apt to fall in love at first sight with any picture which he may focus on the ground-glass screen of his camera, and will probably imagine that as it looks so beautiful it is sure to make a fine photograph. But let the experienced worker peep over his shoulder for a moment, and whisper to him that the picture, pourtrayed in all its natural colours as it is, will look very different as a mono-chromatic photograph. Those moving clouds, with all their tender hues, and their lovely blue background, will, in the photograph, be represented by a blank white space. The brilliant carpeting of green will be almost black. That hedge bounding the field will, in the picture, be represented by a still blacker mass, forming an ugly band, separating the sky from the earth. In a word, the beginner wants educating by experience into what will and what will not make a good picture.

Unfortunately, the power of really appreciating nature is much rarer than many people imagine. How many are there who seem to have no idea of noting the natural beauties of spots which are

constantly before their eyes! One may perhaps cross the bridge over a canal every morning on his way to work, and will be familiar with the sight of the laden barge, and the patient horse toiling on the towpath dragging it along. He may take the trouble to look at the scene, but he would laugh at the idea of there being anything beautiful about it. But show him a photographic print of the same view. He will be delighted at it; he will say that he never saw anything so beautiful. Then he will notice for the first time the ripples on the water; the reflected shadow of the girl steering the boat; the light tint of the load of straw, relieved by the dark sail lying upon it: in short, he will for the first time see an artistic picture, which, when presented to him in all the wealth of colour which nature's palette affords, and with all the poetry of movement which belongs to living things, he had looked upon with a blind man's eyes.

Now, there are thousands of persons in the world who are like my imaginary friend of the canal. They require a surgical operation before they can be made to see a beautiful picture which is immediately before their vision. They have altogether failed to cultivate the power of observation. To this education of the eye, the would-be successful photographer must apply himself. Education of a particular sense is quite as necessary to the worker who depends for success upon the exercise of that sense as education of the hand is to the skilled artisan. Let the beginner get into the habit of studying the effects of light and shade, the

different appearance of a familiar landscape under morning and afternoon light, the manner in which a broad expanse can be broken up and rendered picturesque by the presence of objects in the foreground, and so forth. Let him, if he have access to a picture gallery, study the way in which artists treat their subjects, and he will soon educate himself into the power of *seeing* a picture which others will have passed by and missed entirely.

It is a great advantage, when possible, to go previously over the ground covered by a projected camera excursion, and to make notes of views to be taken. I had an opportunity of doing this once, and I have always remembered the lesson which it taught. An entomological friend of mine, who knew the neighbourhood of Dorking well, invited me to accompany him on a tramp through the most beautiful scenery of the district. Shortly after starting on our day's excursion, it came on to rain, and it rained persistently all day. But we walked through the wet, and most thoroughly enjoyed ourselves. While my friend paused to hunt up some poor wretched beetle, which would afterwards figure in his cabinet with a pin through its internal economy, I was busy making notes of views to be taken on a subsequent occasion. A week afterwards I went over exactly the same ground alone, with my camera and changing box. I took twenty-four pictures, and nearly every one was a gem. I have often exhibited these Dorking views in public with the lime-light lantern, and have received many letters of inquiry as to where the exact

spots are to be found. One gentleman wrote to say that he had lived many years at Dorking, but only recognised one of the pictures—an unmistakable waterfall. Does not this bear out what I have written about the man crossing the canal?

Some of the various manuals on sketching from nature give certain rules for the composition of a picture, and commonly divide their discourse, like an old-fashioned sermon, into three heads. These consist of distance, middle distance, and foreground. I do not believe that any hard-and-fast rules are possible in such a case, for each picture is different. Still, there are a few rules which must certainly be observed by the photographic artist if he wishes to produce pleasing results. For instance, he should not attempt a picture facing the sun. On one or two occasions I have wanted to photograph a church, and the only point of view available has been with my face towards the sun. In such a case the lens must be shaded with something—a hat will do—to prevent the rays actually entering the camera. The horizon should be kept at such a height in the picture that there is neither too much sky nor too much ground. Some persons recommend that the horizontal line should be one-third from the bottom edge of the picture; but, as a matter of fact, the height should vary according to the subject. If, for instance, we take a view from a hill-top, where we have a wide expanse of landscape, with a river or lake, plenty of wood, and one or two buildings, the sky need only be a mere strip. If we give it much room, then we

lose space for foreground, and lose entirely the effect of distance and expanse.

Let us now suppose that the tyro has started upon his first photographic excursion, with his camera, tripod, and changing box, or double slides, which have been charged with plates by the red light of the dark room, and that he is eager to get to work. He should carry with him, in addition to the actual necessaries, a note-book in which he can dot down particulars of each plate used. Such notes should contain particulars of lens, if more than one is in use, of the number of the stop employed; the exposure in seconds; the time of day, the date, and notes regarding sunshine, cloud, etc. Such notes, when afterwards studied by the side of the negatives to which they refer, will be of immense assistance in correcting faults. One fact he will quickly learn from them will be that the photograph of a given subject, taken under morning light, will require about double the exposure if taken an hour or two after noon. The same difference will be apparent between spring photographs and those taken in late summer. One more adjunct to this paraphernalia should not be omitted by the worker with double backs. Let him have some strips of gummed paper from the edge of postage stamps, and as each plate is exposed and shut up in its slide, gum a piece of paper over its shutter, as a reminder that it must not again be moved.

Having chosen a subject, fasten the camera on its tripod on the ground at the selected point of view.

Do not attempt at first to look through it; but look along its top, so as to get it as level as possible. Let the stand be so adjusted that one leg of the tripod is projecting at the back. Now cover the camera with the focussing-cloth, remove the lens-cap, select the largest stop—or use none at all—and look at the ground-glass, and extend the camera until the inverted image appears as sharp as possible. It will be found that to get objects in the foreground in focus, the camera will have to be extended further than for distant objects, so that to obtain both quite sharp, a stop must be inserted. The largest that will give the desired definition should always be used. If the picture has too much sky, or the opposite fault, the back leg of the tripod can be gently moved forward or backward, as the case may be. But if the objects represented do not fall in their desired places, but must be more to the right or left, do not shift the tripod, but loosen the screw which attaches it to the camera. The latter can then be turned about as desired, until the best aspect is secured. It will happen very often that a tree or building, which is relied upon as an important feature in the foreground, will look so big on the ground-glass as to more than cover it. In such a case, the tripod must be moved bodily back until the image is reduced to more moderate size. Sometimes a high wall or other obstacle prevents the photographer from retiring to a suitable distance from his subject, in which case a lens of shorter focus must be used.

When the subject has been duly focussed, the

ground-glass screen must be removed, the dark slide introduced in its place, and the lens capped. The latter must now be furnished with the particular stop chosen,* and now all is ready for exposure. Cover up the camera as much as possible (it is a good plan to have an indiarubber band fastened to one edge of the cloth, which can be slipped over the lens), pass the hand underneath the focussing-cloth, and gently withdraw the shutter of the slide. Now look at your subject. If a puff of wind comes and shakes the leaves, wait with your hand on the lens-cap until it has passed. Do the same if a figure moves across, if you cannot induce it to stop still for a moment to add interest to your picture. Now remove the cap for a second, or more as required, and again replace it. Push in the shutter of the slide, gum a piece of paper across it, and look out for your next picture.

Remember that correct exposure is the first thing to aim at. Mistakes in this respect may be greatly obviated by cautious development; but nothing is so good as the right amount of exposure in the first instance. It is by no means an easy matter at first. To give an idea of the wide latitude that must be observed according to the amount of light available, I may here quote an experience of my own. On one occasion I was asked to photograph the interior and exterior of a large house. One of the interior views was a magnificent hall, with dark panelling, relieved

* It should be borne in mind that a diaphragm or stop having an opening of ¼-inch diameter, will require four times the exposure necessary with a ½-inch aperture.

by armour, the whole being bathed in a very subdued light. With a very rapid plate, I gave my picture an exposure of two-and-a-half *hours*. I then went outside the house, and took a view of the exterior, using the same stop and description of plate. The exposure now was just two *seconds*. Both turned out to be first-class negatives. This, of course, is a very extreme case; but it shows how the exposure must be regulated by the light available.

I always recommend my pupils to commence by using only one stop of their lens, and to stick to that until they can judge of the exposure required under different lights and according to the class of subject. I also advise them to use at the same time one make of plates. I am certain that many amateur workers fail because they will persist in using different makes of plates. They perhaps admire the work of some more competent friend, when their first question is, "Whose plates do you use?" The answer is given, and straightway a batch of the recommended plates is procured; but the work turned out by their aid is no better than before. I believe, although some commercial plates are better than others, that all are good. The man who supplied faulty ones would quickly lose his custom, and would drop out of the race. The beginner will do well not to commence by making his own, but to use commercial plates until he understands something of their capabilities.

To return to our out-door operations. Let us suppose that the first subject taken is an open landscape, and that the artist has judged the right

exposure with a certain stop to be one second. He takes up the apparatus, and moves forward in search of pastures new. He now passes a wood by the side of the high road—a mass of greenery, relieved here and there by the trunks of silver birch trees. The camera is once more set up, and the foliage seems to fill up the entire picture. Now it is evident that such a subject will require far more exposure than the open view just taken, and it eventually receives three seconds. Again the camera is moved, until an opening in the hedge permits the wanderer to enter the wood itself. A beautiful glade of trees, with the branches almost meeting overhead, strikes his attention. The picture seems so dark on the ground-glass that, were it not for a few bright branches that meet the eye close at hand, it would be a very difficult subject to focus. The exposure can be prolonged to perhaps three minutes, or a good deal more; and yet, when the picture is afterwards developed, it may be found to be much under-exposed. As a rule, the beginner is far more likely to err on the side of over-exposure; and this is well, for an over-exposed plate can be turned into a decent negative; an under-exposed one is good for nothing.

CHAPTER IV.

PORTRAITURE.

ALTHOUGH the majority of amateurs will be content to produce landscapes, they will also have a natural wish to try their hands at portraiture. The difficulties of this branch of art are sufficiently attested by the very dreadful productions very often shown by amateurs as examples of their skill. Still, for all this, it is possible, if care and thought be given to the work, to produce a likeness and picture of a very pleasing character. Most amateurs, when they do try anything of the kind, are content to let their model stand or sit in the open air, taking advantage of any natural background that a garden wall or a hedge will afford. But, under such circumstances, the operator has no control over the light from the sky; and this light, beating upon the sitter's head, and being reflected strongly from the glistening hair, very often in the finished picture gives the appearance of premature baldness. This is avoided in some degree by using a fixed background, such as a screen covered with brown paper, with a roof of the same character projecting above the sitter's head. But, even with such an arrangement, the picture is seldom satisfactory, and suffers much from contrast with one taken by a professional photographer in a proper studio.

Moreover, the operator will not care for the trouble and inconvenience of a method so dependent upon fine weather.

Before the advent of gelatine plates, no one would have thought of attempting portraiture in an ordinary room, for the simple reason that want of light would have caused the exposure to be protracted to a prohibitive extent. But now, by the help of extremely rapid plates, this want of light is compensated for, and a picture can be taken indoors in from ten to twenty seconds.

One of the first requisites to ensure success is a suitable background. This need not be larger than five feet by four. This size will allow for a three-quarter length figure, and beyond this the operator should not attempt to go. Full-length figures require an amount of lighting from top to toe which is not attainable in ordinary rooms. A background for the purpose can be bought; but many will prefer to make their own, and this is by no means a difficult matter if the following directions be observed.

Make a rough frame of wood of the size required. The wood may measure 2½ inches by 1 inch, or thereabouts, and can easily be obtained at the sawmills. It need not be planed; for its office is only of a temporary nature—namely, to serve as a support to the material of which the background is made whilst being coated with colour. Its corners should be made, however, with lap-joints, so that the frame shows one flat surface. Upon its face is carefully tacked a piece of strong sheeting, the edges of which

are tightly pulled over the edge of the frame and tacked outside, just in the same manner as a painter's canvas is fastened to its support. When the material is firmly fixed, without showing any trace of a wrinkle, the colouring may be proceeded with.

To make the colour, take about two pounds of common whiting, break it into pieces in a large basin, and pour enough warm water upon it to cover it. Let this stand for ten minutes; then, with a spoon, stir it up until it forms a thick white cream, free from lumps. To this cream add in small quantities some drop-black, which has been previously rubbed down on a glass slab with a palette knife with some water. After every addition, well stir the mixture, so that the black is well diffused throughout its mass, until the whole assumes a pearly-grey tint. Like nearly all distemper colours, the tint is deceptive; for it will dry of a much lighter tone than it assumes when wet. But the real colour can easily be ascertained by smearing some of the compound upon a card and drying it.

When a satisfactory colour is arrived at, the mixture must have some size added to it to bind its particles together; otherwise it would rub off when dry. About two ounces of good size, dissolved in a breakfast-cup full of hot water, will be about the right quantity. Add this to the contents of the basin, stir well, and the paint is ready for use. With a good large brush paint over the stretched background, crossing and re-crossing the lines described by the brush, so as to insure a good surface. If the

brush works stiffly, add a little more size and water. The background can now be left until it is quite dry, after which it can be cut from the frame and rolled up on a roller. But, of course, it can, if preferred, be left as it is.

With regard to the relative positions of sitter, background, and camera, a great deal might be written; for these positions must vary very much with the shape of the room at the disposal of the photographer. If the model be placed too near a window, then the resulting portrait will consist of such strong contrasts of light and shadow as to look like so much chalk and soot. If, on the other hand, the sitter is far away from the window, the portrait must have an impossibly long exposure. In the annexed diagram (Fig. 10) the best positions are indicated for a room with one window—and, indeed, for a room with more than one window; for one only should be employed, the rest being darkened. In this diagram, W is the window, C the camera, B the background, S the sitter, and E a screen so placed that it will reflect light upon the shaded side of the figure.

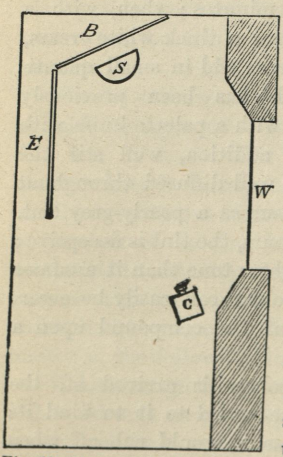


Fig. 10.—Arrangement of Necessaries for Portraiture.

This screen may consist of a clothes-horse covered with a white sheet, and should be as near the sitter as possible without encroaching upon the picture. A cheval glass is also a capital means of lighting up the dark side of the sitter. Should the window admit direct sunlight, the panes should be shielded with white tissue-paper, which will afford then a beautifully soft light. I can hardly trench upon the subject of posing. The amateur must be left to his own taste in this matter, and will do well to study the works of others, both painters and photographers. In photographing in a room, I have often found great advantage in using a candle flame as a guide to sharp focussing. If the light be very poor, and there is some difficulty in getting a sharp image, let the sitter hold a lighted candle in the same plane as his features. The operator can then focus the flame itself, and the picture will be all right in this respect.

Of course the portrait will be obtained with the shortest exposure by using a portrait lens; but this is not absolutely necessary. A cheap single lens will do the work, or an ordinary double-combination landscape lens can be used. It should in any case be of long focus, or the picture is liable to suffer from distortion.

CHAPTER V.

THE DARK ROOM AND ITS FITTINGS.

THE amateur photographer should, if possible, have a room to himself in which he can carry on his various operations without interruption. I know well that good pictures have been produced in hastily-improvised dark rooms, and if the amateur merely aims at the occasional development of a negative or two, such accommodation may answer his purpose. But for those who wish for higher flights, and would enter upon the work of plate-making, a room, or den, which the worker can call his own, is a *sine quâ non*. The room which I myself devote to this purpose also serves me occasionally as a carpenter's shop, and a place for more general work. By a simple arrangement, I can draw a red screen in front of the window, and the room is instantly ready for developing a a plate, or for other photographic purposes. The convenience of this plan must be experienced to be appreciated, and I cannot recommend it too strongly.

The screen is made thus—First of all construct for yourself, or have made for you, a flat frame of such a size that it will lap over each side of the window some few inches. If the window be large, the frame will require a cross piece in the centre to hold it firmly together, and this will in no way interfere

with its efficiency. Over this frame stretch a piece of the red fabric known as ruby medium, which is sold on purpose for photographic use. The edges of this fabric must be secured to the frame by tacks and glue. Now glue all over the red surface orange paper which has been stained with a coating of aurine dissolved in spirit. This paper ready prepared can also be purchased. The frame thus made admits plenty of light of such a quality that the quickest plates are safe during development. It would not, however, be safe to trust to daylight, although thus filtered, for plate-making. For that purpose the red lamp is far better.

Having constructed the frame, the right and left hand faces, where they will eventually touch the window frame, must be covered with two thicknesses of felt, so that no light can creep in there. Two grooves are now made out of pine, double the length of the frame. They are fixed above and below the window frame, and project beyond either to the left or right, whichever may be the most convenient. The frame slides between these grooves, so that when in use it is in front of the window, and when not wanted is slid away against the adjacent wall. In cases where space is wanting for this arrangement, the frame can be hinged at the top, and can have a fastening button below. A cord working over a ring in the ceiling can then be arranged to pull it out of the way when not wanted. The method can be modified in other ways, and the arrangement must be entirely governed by the construction of the room, and the position of the window therein.

If possible the dark room should have a sink with a tap above it. One can manage without it by using a bath and a water-can, but the labour of fetching to and fro is altogether saved if a sink and tap are at hand, to say nothing of the convenience which they afford in all sorts of other ways. The annexed diagram (Fig. 11) will show the general positions of the

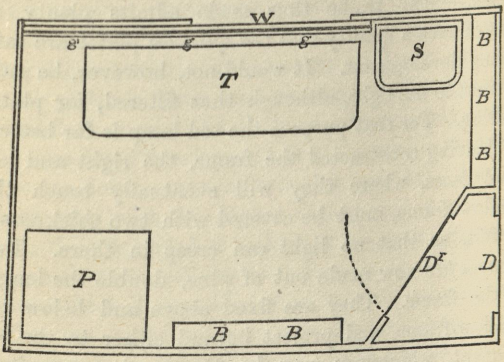


Fig. 11.—Plan of Dark Room.

various requirements of the room which I myself use, and it will serve as a guide to others.

W is the window, S the sink, T a large table, fitted with drawers for the temporary accommodation of sensitive plates, when making transparencies, and for various other articles; P is my dark cupboard, used for storing plates, etc.; B B are shelves one above the other for bottles containing chemicals, etc. Beneath the sink is a rack for dishes. D is the door proper of the room opening outwards;

D I is an inner door which I have added myself. The convenience of double doors will be apparent when such an operation as plate-making is going forward, for one can enter or leave the room without letting in any light from outside. Between the two doors there is just room enough to stand comfortably in the interval which elapses between the closing of one and the opening of the other. In the absence of such an arrangement a thick curtain must be placed over the one door, but it is not half so convenient, and it harbours that *bête noir* of the plate-maker—dust. I will now briefly describe the chemicals which will enable the photographer to commence work, so far as the making of negatives from purchased plates is concerned. I give in each case the quantity advisable to start with, and its approximate price.

Neutral oxalate of potash, 1 lb., price about 1s. I have mentioned elsewhere how this can be compounded at a cheaper rate. Otherwise boiling water must be saturated with the bought crystals, and bottled for use. This mixture keeps indefinitely.

Sulphate of iron, 1 lb., price about 3d. This is kept in special bottles, as directed elsewhere.

Pyrogallic acid, 1 ounce, price about 1s. This can be kept in its original bottle, or part of it may be be mixed as a stock solution (see directions for developing plates).

Liquid ammonia, 880°, ½ lb., price 6d. To be kept in screw-stoppered beer bottle, or mixed with an equal bulk of water and kept in ordinary bottle.

Bromide of potassium, ½ lb., price about 10d.

Hyposulphite of soda, 1 lb., 3d. This salt should be kept in a covered jar. In moist air it becomes deliquescent; therefore keep it dry.

Methylated spirit, 1 pint, 6d. Be careful to get the pure spirit. As sold at many of the shops it is mixed with gum for the use of French polishers; it is then called methylated finish. Some persons do not know the difference, and will innocently supply the one for the other.

Citric acid, in crystals, 2 ounces, price 6d.

Bicarbonate of soda, 2 ounces, 2d.

Alum, 1 lb., 2d. This can at once be put in a half-gallon bottle, and filled up with water. As the solution is used more water is put in, until the layer of alum at the bottom of the water is exhausted.

Bichloride of mercury, ½ ounce, 3d. This is such a very poisonous salt that it had better be at once mixed up with a like quantity of sal ammoniac, and 12 ounces of water. This forms one of the intensifiers recommended.

Chloride of gold, one 15-grain tube, price 2s. *See* directions for toning prints.

Acetate of soda, 4 ounces, 4d.

Other chemicals may be wanted for making up special formulæ as the tyro progresses in his knowledge, but those quoted are sufficient at the outset.

Let every chemical be kept in a bottle. If laid about in packets, subject to the air and dust of the laboratory, they quickly become unfit for the delicate work they have to do. Stock solutions, which are

constantly in use, should be kept in bottles of different shapes, so that they are easily recognised by touch in the dim red light allowable.

The following articles should also find a place in the dark room :—Several dishes for development, etc., —ebonite are the best—a plate-draining rack, a pneumatic plate-holder, a retort stand, a pair of scales, with weights from 2 drachms to $\frac{1}{2}$ grain, one or two glass funnels, filter papers, cotton wool, two glass rods, and negative varnish.

CHAPTER VI.

DEVELOPMENT OF THE LATENT IMAGE.

I REMEMBER once witnessing the performance of a melodrama, in which the discovery of the villain of the piece depended upon a photographic incident. A little black boy sat himself before the camera, and directed a friend to uncover the lens, and to run to a certain tree some hundred yards away before he returned to re-cap the instrument. The journey to the tree and back was to allow time for the necessary exposure. Whilst the operator was absent, a Red Indian crept in, to slow music, and tomahawked the boy, in order to steal some letters he was carrying. The operator then returns, and, seeing the boy killed, fancies that the camera has been the delinquent; so he proceeds to smash it to pieces. But, all of a sudden, the sensitive plate drops out, and the man recognises the portrait of the murderer, with his weapon uplifted above the boy's head. By this means the Red Indian is tracked and brought to justice.

Now, it is very certain that the ingenious contriver of this incident was not a photographer; or that, knowing better, he sacrificed truth to dramatic effect. As a matter of fact, the sensitive plate, when it is taken from the camera, looks exactly as it

did when it was first placed there. The change which has taken place on its surface is not visible; nor can it be made visible until the operation called "development" is proceeded with.

Development must take place in the dark room, either by the light of a ruby window or of a red lamp. In either case, if the plates be of a very rapid quality, they should be kept at first at a distance from the source of light; but, when the development has once begun, this precaution is not needed. Indeed, in the case of iron development, which will be described first, the solution used is itself of such a red colour that it forms its own protection to the plate—so that, once the plate below the surface, a naked candle flame could be used without much risk. This, however, is not to be recommended, as a ruby lamp will afford all the light requisite.

There are a great number of different methods by which the latent image received in the camera on a gelatine plate may be made to appear; but we will here only consider two—namely, iron development, or the ferrous-oxalate method; and alkaline development, in which pyrogallic acid and an alkali play the principal parts. Some advocate one method and some the other, and there has been many a controversy as to which is the best. Perhaps the most curious part of the matter is that, while English professional photographers are wedded almost without exception to the alkaline development of plates, their continental brethren are almost exclusively patrons of the ferrous-oxalate formula. The beginner will certainly find the

latter method the easier, and that therefore will be first described. He will afterwards find that certain makes of plate will take more kindly to the alkaline method; so that it is highly desirable that he should know the particulars of each. But let him guard against one mistake. Let all dishes and vessels used for the one method be perfectly cleaned before they be used for the other; for a mixture of the two makes a dirty compound akin to common writing-ink.

DEVELOPING WITH FERROUS-OXALATE.

In spite of what its detractors may say, this method of developing a plate has many advantages, not the least of which are its cleanliness—for it will not stain the fingers—and the possibility of using the same solution for a number of plates. Two standard solutions are required, which should be compounded some hours before they are wanted; for both are made with boiling water, and must be allowed to cool.

A	Neutral Oxalate of Potash	8 oz.
	Boiling water	1 pint.
B	Protosulphate of Iron	12 oz.
	Boiling water	1 pint.

These quantities in both cases will make saturated solutions; that is to say, the water will take up a certain quantity of the salt, and no more. If more were added, the excess would appear as crystals at the bottom of the containing vessel.

In the case of solution A, it will probably be found to turn rather milky. This is due to the formation of oxalate of lime, owing to the use of hard water. It

is of no consequence, for the slight precipitate sinks to the bottom of the vessel, and the clear portion can be bottled off for use. In mixing the crystals with the boiling water, the mixture should be stirred until they are thoroughly dissolved. This applies to both A and B. The first-named solution, A, requires no special care in the way of preservation; it will keep indefinitely in an ordinary bottle. But the other solution will quickly spoil if in contact with air; so it should be put up in small bottles, say of one ounce capacity, filled up to the cork, or else kept in bulk in a special form of receptacle. Here is a contrivance made out of a pickle-bottle, which I devised for the purpose. The cut (Fig. 12) almost explains itself. The bottle is fitted with a bung, in which are pierced two holes for the reception of glass tubes. One tube is short, and is crowned with a thistle-head, such as can be obtained at any philosophical instrument maker's. The other reaches to the bottom of the bottle, and is bent over at the top. The contrivance is used in this way: it is filled by the smaller tube three-parts full of iron solution, on the top of which is poured an ounce of castor oil. This, of course, floats on the top of the liquid, and seals it from the air. Upon blowing through the small tube—and the lips can be pressed against the thistle-top for the purpose—a

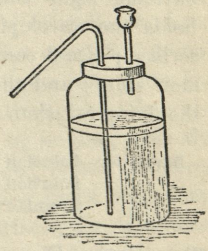


Fig. 12.—Bottle for keeping Iron Solution from the Air.

stream of liquid is forced through the bent delivery-tube. Iron solution can be kept by this means indefinitely; but, if kept in an ordinary bottle, it quickly becomes useless.

We will suppose that the beginner has prepared these stock solutions A and B, and also another consisting of

Bromide of Potassium	20 gr.
Water	1 oz.

He can now proceed to develop a plate.

In my own practice, when I am developing with ferrous-oxalate—which I often do—I place on my dark-room table four dishes in a row. The one on the extreme right contains pure water; its neighbour holds the developing mixture—to be presently described; No. 3 contains a saturated solution of common alum; and the extreme left-hand dish contains the fixing solution.

Developer—Solution A	2 oz.
Solution B	½ oz.
Bromide Solution	4 drops.

The solution B must be poured into A, and not *vice versa*, or a thick muddy mixture will be formed which must be thrown away and wasted. The developing solution, when mixed, should be of a rich red colour. If this is not the case, and if it should throw down a precipitate, too much boiling water has been used in the first operations. It is therefore far better to add several ounces too little than half an ounce too much;

for in the first case you will have your solutions saturated, and in the second you will not.

To make the fixing solution, mix the following :—

Hyposulphite of Soda	2 oz.
Warm water	½ pint.

The crystals can be placed in the left-hand dish, and the warm water poured upon them. They will soon dissolve, and the solution will quickly become cold. Everything is now ready for the development of a plate, and we will suppose that we have one which has just been taken from its slide after exposure in the camera. First of all, soak it in the right-hand dish of plain water. Many operators dispense with this ; but it has the advantage of making the developer afterwards flow easily over the surface, and I am convinced that, in the case of ferrous-oxalate development, it confers upon the plate increased density. After about half a minute's soaking, the plate is hastily drained by holding over the dish vertically, and is then placed in the developer (dish No. 2). Carefully see at this point that there are no bubbles sticking to the surface ; for, if allowed to remain, every one will afterwards be represented by a white, clear spot. Such bubbles can be readily removed by passing a flat camel-hair brush over the plate as it lies in the dish. We can now gradually watch the image creeping out, and a very wonderful sight it is too. First the strongly-marked lights appear—in a landscape the sky, in a portrait the face, or possibly some white portion of the dress, such as the collar or

cuffs. Next the half-tones appear, full of delicate detail; while the shadows remain almost white—the extreme shadows quite white. (We must bear in mind that we are producing a negative in which the lights and shadows are all reversed.) We need not be in a hurry to remove the plate until the details begin to disappear, and the picture seems almost on the point of being blotted out in a general darkness. Now take up the plate, wash it under a tap or with a jug of water, place it in the alum solution for a minute or two, and then examine it. Upon holding it up towards the red light—or it will do no harm to look at it by ordinary lamplight for a few seconds at this stage—it will be found that the glass is quite opaque. Upon examining the back of it, it will be noticed that the blackening of the image only shows in certain parts, and that the bulk of the sensitive film still remains white. It is to dissolve out this unused portion of the chemical surface that the plate is put into the fixing bath, previous to which operation, however, the alum solution must be entirely removed by copious washing.

It is as well to watch the gradual action of the soda solution in this last dish. First of all, the edges of the plate will become quite clear; then it will seem as if the film were gradually eaten away by the fixing solution until the action is complete. It is as well to let the plate remain in the fixing solution for some minutes after every trace of white has disappeared from the glass. The negative—for such it now is—is then well washed under the tap, and placed

in a deep dish of water for some time, say two hours. At the end of this period it may have another good rinse, and can then be placed in a rack (Fig. 13) to dry.

Among the objections which have been urged against ferrous-oxalate development is the one of expense. But this plea can certainly not be maintained, for the same developer may be used over and over again. The quantity at first mixed, say 2½ ounces, will develop a dozen 5 × 4 plates at least, one after the other, gradually getting slower and slower in its action. But it need not be thrown away, for it can easily be renovated for another occasion. Put it into a *white* glass bottle, add to it two drops of a solution of tartaric acid (acid, 20 grains; distilled water, 1 ounce), expose to light—sunlight, if possible—for a few hours, and it is ready for work once more. In the country last year I developed 150 negatives with one half pint of iron solution which I took with me, and renovated as described from day to day.

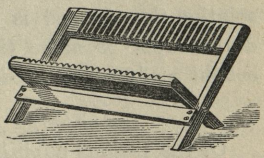


Fig. 13.—Plate-draining Rack.

In case the amateur should be in some place where neutral oxalate of potash is not readily obtainable, he can easily make it for himself, thus :—

Carbonate of Potash (salts of tartar) ...	**1 lb.**
Oxalic Acid	**12 oz.**
Warm water	**3 pints.**

In a large basin place the potash and pour upon it the

water; stir until dissolved. Now gradually add the crystals of oxalic acid a little at a time, or the effervescence will cause the mixture to bubble over. Shake the crystals in until the whole are added. In an hour or two the compound is ready for use, and can take the place of solution A in the developer. The solution thus formed is most reliable, and is a good deal cheaper to make than if oxalate of potash be bought ready crystallised.

ALKALINE DEVELOPMENT.

Of the various published formulæ for alkaline development, the most simple, and therefore the one which the beginner should first try, is the following, which will be found to suit all the commercial plates at present in the market. It has the great advantage of requiring only one stock solution, a few drops of which only are required to develop each plate. To an amateur, therefore, who wishes to have the means of developing a plate on his travels abroad, this plan is invaluable, for he need only encumber himself with this one liquid. The other chemicals required being in a dry state.

STOCK SOLUTION.

Bromide of Potassium	2 dr.
Water	4 oz.
Liq. Ammonia, *fort.*	2 oz.

The plate is first allowed to soak in water in the developing dish for half a minute. While it is soaking, add five drops of the above solution to two ounces of water in a glass measure. Pour off the water from

the plate, and immediately let the ammonia solution take its place. While this is upon the plate, put into the glass measure three grains of pyrogallic acid. A bone spoon can conveniently be employed for this purpose. Empty the contents of the dish upon the dry pyro, which will immediately dissolve, and then return the mixture to the plate. If the exposure has been properly timed, the image will begin to appear in about one minute, and will gradually gain strength. When all the details are visible, and the development seems to hang fire, drop three or four more minims of the ammonia solution into the cup, turn the developer into it, and again restore it to the plate. This fresh accession of ammonia will immediately take effect in darkening the image, and in half a minute, or a trifle more, the operation will be complete. Now pour off the developer into the sink, and wash well under a good stream of water from the tap, taking good care that every trace of developer is washed away. Now put the plate in the alum dish, and in due course transfer it to the fixing solution.

In developing by the alkaline method the darkening of the film should on no account be allowed to go so far as in the case of ferrous-oxalate development, and for this reason: the colour of the pyro-developed negative is of a yellowish tinge, and, therefore, more non-actinic than a negative developed with ferrous-oxalate. In the after operation of printing, a pyro negative, which appears thin when compared with one developed with iron, will possibly give a far

more vigorous print than the latter, simply on account of the difference of colour between the two. The weighing out of small quantities of dry pyro-gallic acid every time some plates have to be developed would be out of the question; and this method of using it dry would not be recommended were it not for the circumstance that when weighed out once or twice the right quantity can be easily guessed at. The exact quantity here recommended is not, moreover, at all essential to success, for a wide margin can be allowed. Let it be remembered that the pyro gives density, that the ammonia acts as an accelerator, and that the bromide is a restrainer. A bottle of bromide of potassium (twenty grains to one ounce of water) should be at hand to check development, when the image flashes out rapidly, and thus indicates over-exposure. In this case at once pour off the developer, and flood the plate with the bromide solution. Development can then recommence, using a fresh mixture containing double the quantity of pyro, and half the quantity of ammonia solution. Where the first plate of a batch indicates over-exposure, and there is a reasonable presumption that the rest suffer from the same complaint, the error can be remedied thus:—Instead of placing the plates in plain water before development, let them soak for a minute in a solution of bromide of potassium (three grains to the ounce of water). This plan seems to exert a greater check upon the plates than if the bromide were merely added to the developer.

Mr. G. W. Webster was the first to suggest the

use of a soluble citrate in the developer to check over-exposure, and he claims that its use will actually save a plate which has received two or three times the exposure which it should have done. Citrate of soda is found to give the best results, and the strength of the solution recommended is ten per cent. (*i.e.*, one ounce of citrate of soda to ten ounces of water). A bottle of this should be kept at hand in the developing room. If a plate gives evidence of over-exposure by flashing out under the developing fluid instead of appearing in a gradual manner, a drachm or two of the citrate solution is added without loss of time, and the plate will be rescued.

When the operator is at home, surrounded, let us hope, with better conveniences for work than when he is on the tramp, he will doubtless prefer keeping the pyro as a stock solution ready for work. Pyro in water will only remain good for a few hours, but there are many means for preserving it. Here is a stock solution, which will remain good at least for some weeks :—

Citric Acid	**2 dr.**
Water	**5 oz.**
(dissolve and add)—	
Pyrogallic Acid	**160 gr.**

One drachm of this solution will contain just four grains of pyro, and this quantity added to, say three ounces of water, will develop a plate. I need hardly say that the ammonia and bromide solution must be added as well.

The strong liquid ammonia used in photography

is unfortunately not a stable compound; it is constantly giving off gas, and is weakened every time the stopper of the bottle is removed. A warm room, or even the warmth of the hand, is sufficient sometimes to blow the stopper out of the bottle. For this reason it is well to mix it at once with an equal bulk of water. I keep my ammonia (and various other chemicals of a fugitive nature) in bottles having screw tops made of vulcanite, round which is a band of indiarubber. These bottles have lately been introduced for beer. They are very strong, and can be had in pints and half pints. I look upon them as a very great boon for use in the laboratory.

Although ammonia is far more widely used than any other alkali for development of gelatine plates, it is by no means the only one which can be put to that purpose. Many use common washing soda, and I can certainly testify to the beautiful negatives which can be obtained with it. It has the merits of being a fixed alkali, it gives off no fumes, and is at hand in every household. The following is a good method of employing it.

Into a quart bottle put a quarter of a pound of washing soda, and fill up with warm water, add to this twelve grains of bromide of potassium. This mixture will keep good for any length of time, and can be regarded therefore as a stock solution. When required for use, put into the developing cup one grain of dry pyro for every ounce of solution required, the quantity to be measured by the size of the picture to be developed, and pour upon it the soda solution.

This last developer has a sweet simplicity about it, and works well. Here is another formula, in which the pyro figures as a stock solution, and keeps perfectly well indefinitely—

A	Oxalic Acid	96 gr.
	Pyrogallic Acid	64 gr.
	Bromide of Ammonium	32 gr.
	Water	1 quart.
B	Washing Soda	4 oz.
	Water	1 quart.

Mix equal quantities of each immediately before use. In using either of these soda developers it is as well to have at hand the means of accelerating their action in case of under-exposure. A saturated solution of soda will accomplish this, a few drachms being added to the contents of the developing cup, if the image seems to be unusually slow in gaining the requisite density. If, on the other hand, the picture flashes out too quickly, the bromide solution should be ready to check the action in the manner already indicated.

Here is another simple developer, which is a favourite, but for some hidden reason it does not answer with all varieties of plates.

Citric Acid	15 gr.
Bromide of Potassium	60 gr.
Sulphite of Soda	120 gr.
Liquid Ammonia	3 dr.
Rain, or distilled water	1 quart.

In use add one grain of pyro to each ounce of solution.

Dr. Eder, a well-known scientific photographer,

recommends the use of the alkali potash in the developer, to take the place of the ammonia or soda, cited in the usual formulæ. He claims for this substitute several advantages, among which are the stable nature of the alkali, the possibility of making with it a concentrated solution which is small in bulk; its capability of prolonged action on the film without stain or fog, and the brilliancy which it will give to a negative. Here is his recipe—

A	Pure Carbonate of Potash	90 parts.
	Water	200 „
B	Pyrogallic Acid	12 „
	Sulphite of Soda	25 „
	Citric Acid	1½ „
	Water	100 „

Before use mix with three ounces of water forty to sixty drops of A, and the same quantity of B. This will give a vigorous image; but if finer and softer results are required, a larger quantity of water must be used.

In compounding these developers, the utmost cleanliness must be observed, with regard not only to containing vessels, but also to the scale pans in which the chemicals are weighed. These should be of glass, and should be carefully wiped out with a piece of clean tissue paper before use. Liquids must be measured in the graduated glasses sold for the purpose, it being understood in all formulæ that ounces of liquids mean ounces by measure, and not actual weight.

It will be found that sometimes after development and fixation a plate shows some stains, which it is

highly desirable to get rid of as speedily as possible. This can be done by leaving the plate, after it has been fixed and well rinsed under the tap, in the following solution for two or three minutes.

Alum	2 oz.
Citric Acid	1 oz.
Water	10 oz.

This solution will keep well, and can be used over and over again. Its action is almost instantaneous. It is only required after alkaline development. Ferrous-oxalate development leaves in its wake a slight milkiness in those parts of the negative which should look like plain glass. This is due to oxalate of lime, formed in the film by the use of hard water. It is of no consequence, and usually disappears when the plate is varnished.

I have already hinted at the necessity for prolonged washing of the plate, after removal from the fixing solution. Unless the hyposulphite of soda be completely eliminated, the negative will most surely fade. Any one who cares to try the truth of this statement can do so very easily by a simple experiment. Take a negative—a faulty one will do—and after removal from the fixing bath, and rinsing it under the tap, place it in a vessel of water, so that only the lower half is immersed, for about two hours. It will be found, at the end of this time, that the upper part of the negative has faded down to about half its previous tone. When I have occasion to develop a batch of plates away from home, I place them, after fixing and rinsing, in a pailful of water,

the film side towards the sides of the pail. The plates standing on their edges in this manner are soon thoroughly washed, but they should each have a final rinse under the tap before being allowed to dry.

A simple form of washing, draining, and drying

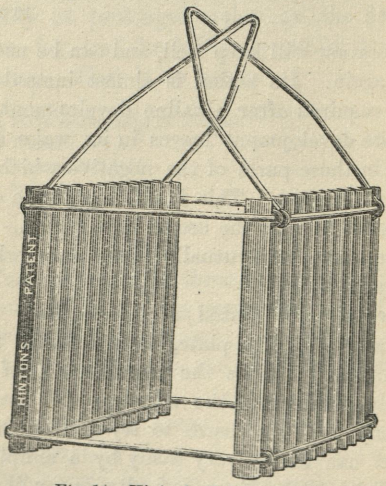


Fig. 14.—Hinton's Folding Rack.

rack has lately been introduced by Messrs. Hinton & Co. It is a very efficient contrivance, and can be folded up when not in use.

Before leaving the subject of development, a few difficulties which are likely to occur to the beginner may be briefly alluded to. In the first place, different makers' plates behave quite differently, even if treated with precisely the same developer. It requires a

certain amount of experience to know which developer is most suitable with a given make of plate. Another difficulty is found in judging the precise amount of density which the plate has attained under development, and calculating therefrom whether the operation is complete, or whether the action should be allowed to go further. This last difficulty is caused principally by the small amount of light permitted in the dark room. But it must be remembered that after the image has once made its appearance, the amount of light can be greatly increased without any danger of spoiling the plate. It would be a good plan in the dark room to have part of the window or lamp protected with yellow glass only. This could remain covered with an opaque screen under ordinary circumstances, but could be uncovered just at that moment when the development seems complete. By holding up the picture to such a light, the real density obtained could be far better gauged than it can be under ordinary circumstances. It is well known that clever photographers are often deceived in this matter of judging density, and will under- or over-develop a plate now and again in spite of all their experience.

Remedies for both these faults will form the subject matter of the next chapter.

CHAPTER VII.

INTENSIFICATION AND REDUCTION OF NEGATIVES.

From what has been already written, it will be evident that a plate, even a properly exposed plate, may, in its subsequent journey through the dark room, become either too thin to give a perfect picture in the printing frame, or so dense that the operation of printing is enormously prolonged, the light in this case not being able to get through the darkened and discoloured negative. Luckily a remedy can be found for both these contingencies; but let it be remembered that prevention is better than cure, and that a negative which needs no doctoring is, compared to a faulty one, as a healthy man is to an invalid. A thin film, caused either by under-development or over-exposure, can be endowed with extra density by the process known as Intensification.

Before this process is attempted, the negative must not only be very thoroughly washed, but the last trace of the fixing solution, which seems to stick to the gelatine like a limpet to a rock, must be removed. For this purpose various solutions have been recommended. Captain Abney advises the use of peroxide of hydrogen. This compound can be easily obtained, for it is extensively used as a hair restorer, giving that gold colour to the hair which was so fashionable

not many years ago. As sold, the peroxide is too strong for photographic use; it should be diluted with forty times its bulk of water. When the plate has remained in this mixture for about fifteen minutes, and has been well washed, the intensification can proceed. The first method which I recommend is the mercurial intensifier. I am aware that many persons object to this because it has the character of not being permanent. I can only say, in answer to this, that I have some negatives in my possession which were treated in the way about to be described, and they are as perfect as when they were operated upon about three years ago. Soak the negative in the following solution :—

Bichloride of Mercury	½ oz.
Sal Ammoniac	½ oz.
Water	12 oz.

If it should only require a moderate amount of additional density, let the negative remain in the solution until the film acquires a uniform grey tint. The action can be hastened by rocking the dish. But if the negative is very thin, but still possesses plenty of detail, it may remain until the image is bleached perfectly white. Now wash the picture most thoroughly under the tap, and transfer it to a bath made thus—

Liquid Ammonia	2 drachms.
Water	6 oz.

The effect of this solution is almost instantaneous. The film becomes blackened, and merely requires an after-rinse under the tap before it is ready for drying

and varnishing. The mercury solution can be put away for future use, and can be employed again and again until exhausted. Keep it in a safe place under lock and key, and use it with caution, for the mercurial salt employed is the active poison known as *corrosive sublimate.*

Another plan for discharging the last traces of hyposulphite of soda from the film previous to intensification is a prolonged soaking in a strong solution of alum; but if time will not admit of this, the same end can be attained by using *Eau de javelle.* This is made as follows, but must be diluted before use with twenty times its bulk of water :—

EAU DE JAVELLE.

Chloride of Lime (dry)	2 oz.
Carbonate of Potash	4 oz.
Water	1 quart.

Mix the potash in ten ounces of the water, the lime in the remainder; mix, boil, and filter.

Mr. B. J. Edwards has published a very useful modification of the citric acid and alum clearing solution already described, by which pyro-developed plates are much improved in colour. The plate to be treated is taken out of the fixing bath and slightly rinsed, for to gain the desired effect some of the fixing salt must be retained by the film. The following mixture is then applied to it :—

Alum	1 oz.
Citric Acid	1 oz.
Sulphate of Iron	3 oz.
Water	1 pint.

The colour of the negative soon changes to a warm black. Perhaps a more convenient way for compounding the mixture would be to take, say, four ounces of the clearing solution before recommended, and to add to it just before use one ounce of saturated solution of iron, which employers of the ferrous-oxalate system of development will already have in stock. The same mixture can be used as an intensifier, by the addition of a few drops of a solution of nitrate of silver:—

Silver Nitrate	20 gr.
Distilled Water...	1 oz.

This is poured over the negative repeatedly until sufficient density is gained. But it must be remembered that, where intensification is intended, the negative must be thoroughly washed and treated with the plain clearing solution before the silver mixture is applied. After intensifying with silver, again soak in the fixing bath, and thoroughly wash as usual.

One more method of intensification I will describe, with a reminder that all these methods of improving thin negatives are only to be resorted to in case of need, and that a really satisfactory negative will require no such help.

A	Gallic Acid	1 drachm.
	Alcohol	10 „
B	Silver Nitrate	1 „
	Distilled Water	16 „
	Acetic Acid	20 drops.

For use, mix one part of A with four parts of distilled

water; then add a few drops of B, and apply to the plate.

Intensification is needed when a plate has been over-exposed, and when the fault has not been corrected by careful development. This is an accident which can easily occur; so it is as well to have a remedy at hand. Such a negative will be full of detail, but so thin and devoid of contrast that it will never yield a good print. We have now to consider the opposite case of a negative being so dense that its details are completely masked in its own substance. Such a case is the result of over-development, and is a common fault with those who do not allow themselves sufficient light in the dark room. Mr. Spiller recommends the following cure: Make up two stock solutions,

A—Alum	**4 oz.**
Copper Sulphate (blue stone)	**4 oz.**
Common salt	**8 oz.**
Water	**1 quart.**
B—A saturated solution of common salt, filtered.	

Mix these two solutions in equal parts, and immerse the negative therein. In very bad cases, use a larger proportion of the copper solution. When the required amount of reduction has taken place, wash, with B used alone, soak in water, and dry.

A few words about drying negatives will not be out of place. If the glasses are put in the draining rack in the open air, especially in sunshine, they will dry in an hour or two. If required in a great hurry, they can be placed in a dish of methylated

spirit for ten minutes. This will drive the water from the films, and cause them to dry very quickly. A pyro-developed negative can be blotted on clean blotting-paper, so as to remove the surface moisture, and can then be put in front of a fire to dry. The pyro exerts a tanning action on the gelatine, which prevents it melting in such a position. But the same treatment would utterly ruin a ferrous-oxalate-developed plate.

Several new developers have been recently introduced, and for special purposes some of them are most valuable. Eikonogen, for instance—first suggested by Professor Meldola, and introduced commercially by Messrs. Marion—will coax detail out of an instantaneously exposed plate when nothing else will bring about that result. Hydrokinone is also a most useful developer for positives, lantern slides, etc. A capital form of it is sold by Messrs. Hinton in one solution, and a two solution developer giving exquisite results is made up by the Fry Manufacturing Company. As ample directions for use are issued by these firms, it is needless to repeat them here.

CHAPTER VIII.

VARNISHING THE NEGATIVE.

THE negative cannot be said to be entirely complete until it is varnished; and this operation should by no means be neglected if the negative is to be printed from upon silver paper, for the paper is apt to give up some of its silver to the gelatine surface and to cover it with red spots. Varnish is, too, a great protection against damp, to which a gelatine film is peculiarly liable. The operation may be omitted when the object of a negative is merely to yield a lantern-slide or transparency, and when its preservation after having fulfilled that purpose is a matter of indifference. In all other cases, the film must for its protection be covered with a layer of varnish.

The beginner may, perhaps, fancy that a brush dipped in any kind of varnish and painted over the negative will do all that is required; but here he is mistaken, for the work requires as much care as any other photographic operation. It is strange that a great many amateurs who can take good negatives fail in this final operation, which, after all, is simplicity itself. I feel certain that, if the following directions are closely followed, the reader will not add to the number of those who so commonly fail.

First of all, place the dry negative on a pneumatic holder, and warm it gently before the fire; but

by no means make it hot. Then pour a pool of varnish in its centre, as shown in Fig. 15; and it can during this operation remain on its holder, if desired. By gently inclining the plate the pool can be made to flow to each corner in succession,

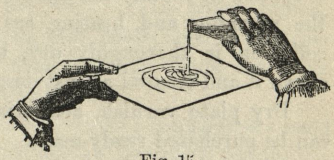


Fig. 15.

and the surplus is emptied away *into another bottle*, as shown in Fig. 16. (Every precaution must be taken to avoid dust. The negative should be gently rubbed with a silk handkerchief before the varnish is applied, and even then some tiny particles may rest upon it; hence the use of the second bottle, so that the contents of the first may not be contaminated. Each speck of dust makes a little comet-like mark on the varnished film.) As the plate is held vertically over the bottle, as shown in Fig. 16, gently rock it from side to side,

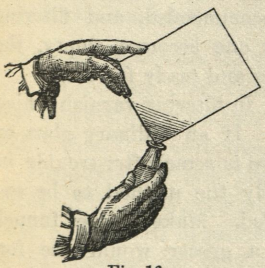


Fig. 16.

so that the fluid, now rapidly setting, may not form straight lines in direction of the dip of the plate. When the plate has almost ceased to drip, hold it before a bright fire for about two minutes, making it quite hot, and it is finished. It is as well to have the plate-rack near at hand, into which each plate can be dropped as

it is done. For extra protection, some persons recommend a preliminary coating of plain collodion, which is applied in exactly the same way as the varnish, only the warming and heating are omitted. When the collodion is thoroughly dry, the varnish is flowed above it and treated as just described.

Dry plate varnish, answering every requirement, can be purchased ready-made. It is sometimes rather too thick for convenient use, in which case it can be diluted with methylated spirit. My own practice is to buy from a reliable shop some best white hard varnish, such as is used for wood-work, and to fill it up with double its quantity of methylated spirit. This makes a capital photographic varnish, but it requires careful filtering before use. Then, by using two bottles, as already recommended, and filtering once more when the first one becomes empty, the compound is always in order and ready for use.

There is a little knack in filtering varnish which it is as well to know of. If an ordinary glass or porcelain filter be used, there is some after-trouble in thoroughly cleansing it. By the method to be explained this trouble is avoided. Make a paper funnel of writing-paper, such as a grocer would use for wrapping up an ounce of tea, gum it up, so that it will not come undone, and cut off the point, so as to leave an orifice large enough to admit a pencil. Into this hole push from the inside a tuft of cotton wool, and pull it through the opening to such an extent that it is firmly held there. Now prop this extemporised filter above a clean dry bottle, and pour in the varnish above. It will filter out bright and clear and quite

free from impurities. (A few drops of spirit may advantageously be poured into the filter in the first instance to moisten the wool.) The paper funnel, when once used, can be cast aside, and a new one employed on the next occasion, thus doing the work efficiently with very little trouble.

The diluted white hard varnish I consider as a good protection to the film under all ordinary conditions. Moreover, it can easily be made to take the pencil, for re-touching, if rubbed with a little powdered resin or pumice with the end of the finger. For those who prefer to make a special varnish, here is a good recipe :—

Orange Shellac	**2 oz.**
Gum Juniper	**1½ oz.**
Camphor	**¼ oz.**
Methylated Spirit	**1 pint.**

Mix these ingredients together, when they will, with occasional shaking, dissolve in the spirit. If the bottle be placed in a warm situation, the gums will dissolve much sooner than they otherwise would. Filter before use.

Negatives are best kept stored in grooved plate-boxes; or they may, with a layer of tissue-paper between each, be wrapped in packets. Even if thoroughly protected with varnish, they should be kept in a dry room.

In case it should be found desirable to intensify a negative after it has been varnished, the varnish can be easily removed by warming the plate and pouring upon it some methylated spirit. Let this remain for a minute or two, and gently rub the surface with a tuft of cotton-wool. Repeat this process until every trace of varnish has been removed. Then proceed to intensify, and, when the plate is dry, re-varnish.

CHAPTER IX.

PRINTING FROM THE NEGATIVE.

THE operation of printing positives on paper, that is to say, the production of finished photographs for subsequent mounting in an album or for framing, is one that had better be postponed until several negatives are complete. For the operations required, consisting as they do of several distinct processes, can be more economically carried out wholesale than if we had only half-a-dozen prints to produce. Indeed, it would be quite out of the question to undertake the work for so few.

The printing operations may be divided into three distinct processes, namely, exposure to light under the negative, toning the prints, and fixing them. These must be considered in detail. We are taking it for granted that the amateur will buy his paper ready sensitised, as paper prepared at home will not, as a rule, keep good more than a few days, while that bought of reliable dealers will, if kept between the leaves of a book made of white blotting-paper, prepared by soaking in a solution of carbonate of soda, and drying, will remain good for weeks. The sheet of paper when bought measures about 22 by 18 inches, and must be cut into pieces the same size as the negatives to be printed from. It is possible to obtain as many as

forty-two pictures, *carte-de-visite* size, from one sheet of paper, if the cutting be performed to the best advantage. The careful operator will measure the sheet and plan out the best way of cutting it to the sizes required without waste. This should be done in a subdued light, but not necessarily in the dark room, for the chloride of silver to which the paper owes its sensitiveness is far less rapid than the chemicals with which we have hitherto been dealing. The greatest care must be taken not to touch the surface with damp hands, and in any case to handle it as little as possible.

The most convenient form of printing frame (see Fig. 17) is that in which the negative exactly fits the space provided for it; but should the pictures be smaller than the frames, a sheet of clear glass must be inserted upon which the negative, varnished size uppermost, must be laid. Then take a piece of the sensitised paper and lay it upon the negative, smooth side downwards, and on the top of this put a few sheets of clean dry blotting-paper. The cloth-faced back is then inserted, the springs adjusted, and the frame is ready for exposure to daylight. As a rule negatives must be kept away from actual sunshine during exposure. If they are very thin through over-exposure in the camera, they must be printed in a weak light. If, on the other hand, they be unusually dense, so

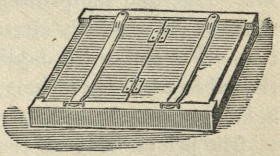


Fig. 17.—Printing Frame.

that the light has some difficulty in penetrating them, actual sunshine will do no harm. The hinged back will allow us to examine one half of the picture at a time, without separating the rest from the negative, and the printing operation must be carried on until it is a good deal darker than we wish it to appear when finished. The reason for this over-exposure is, that the subsequent processes of toning and fixing rob the print of a great deal of its original force.

As the pictures are printed they are removed from the negatives and placed away in a dark box, or drawer, until the whole batch is complete. On a fine day, and the operation should not be begun unless it is fine, a great many prints can be turned out in a few hours, and the printer will find very little time to waste if he carefully attends to the work of examination. For this work daylight is a *sine qua non*, but the subsequent operations can be conducted by lamplight.

The prints being all ready, we can proceed to tone them at once, or reserve them for a day or two. First, they must be put one by one in a large earthenware pan of clean water. This water will become milky, owing to the presence of the free nitrate of silver in the paper. At the end of fifteen minutes, they must be removed one by one to another pan of water, and again to a third at the end of a similar period. They are now ready for the toning bath. The need for some process by which the pictures can be made of a more agreeable colour will be apparent. When the prints are removed from the frame they are of a

dark sienna red, and after being soaked in water to remove the free silver, this tint changes to a still more unpleasant brick-red colour.

The toning bath which I recommend, is made thus—

Chloride of Gold	...	...	...	**1 tube (15 grs.)**
Acetate of Soda ...	...	...	...	**1½ oz.**
Water ...	...	...	...	**2 quarts.**

The gold is sold in glass tubes, which require to be broken before the contents are available. This is easily done by nicking the centre of the glass with a file, when it can be snapped in two over a sheet of clean paper. Put the contents, together with the soda, into a half-gallon stone jar, and fill up with distilled water. The contents of the jar may be shaken once or twice to help in dissolving the crystals. This bath should not be used until at least two days after mixing, and a better result is obtained if it be kept for a week first. The object of preserving this solution in a stoneware jar is to keep it, when not in use, in absolute darkness, for light slowly but surely decomposes it.

The beginner will, probably, as most beginners do, try several formulæ for toning before he attaches himself to one in particular; and for this reason, as well as for the sake of economy, it will be well to make the dry chloride of gold into a stock solution, which can be used as required. If, therefore, the little glass tube in which the salt is contained is broken into a bottle into which 15 drachms of distilled water have been previously put, we have at once a convenient way of

measuring out the precious salt. Each drachm of the solution will represent one grain of chloride of gold. The toning formula, already given, can, of course, be made up in any quantity, and during the time that the tyro is, as it were, feeling his way, it will be well to make up but one-eighth of the amount named.

Here is another recipe, which is fit for immediate use, after mixing, and must be used soon, for it quickly spoils—

Gold Solution	**1 drachm.**
Carbonate of Soda	**10 grains.**
Distilled Water	**10 oz.**

The following toning solution is much recommended for ready-prepared paper, to which it imparts a rich deep colour—

Hot Water	**15 oz.**
Borax	**90 grains.**

Stir the borax into the water and wait until the solution is cold. Then add one drachm of gold solution. In cold weather this bath may be warmed before use. I will give one more formula for a toning bath, which has a great many admirers—

Gold Solution	**2 drachms.**
Boiling Water	**15 oz.**
Lime Solution	**2 drops.**

The lime solution here mentioned is made by mixing one ounce of chlorinetted lime (*i.e.*, the common chloride of lime of the oil-shops) with half a pint of

water. This mixture is well shaken up in a bottle, and afterwards allowed to settle. The clear portion is afterwards decanted off for use. In making this toning bath, put the gold solution in a jug, with a small piece of chalk, then add the boiling water, and lastly the lime—taking care that this latter does not in the least exceed in quantity the prescribed allowance, otherwise the prints will be bleached instead of toned.

In using any of these baths the beginner will do well to make a few trial pictures, and these kept as specimens will do more to make him a good printer and toner than many pages of written instructions. Take a well-printed photograph direct from the printing frame, and cut it into four quarters. Wash them, as already directed, and then put them into the toning bath selected. Let one remain in until a certain colour is obtained, and the others for varying periods, marking with a pencil, on the back of each, the time of immersion, and the resulting colour. The four pieces can afterwards be fixed, washed, and dried, and then the operator will be able to judge which is the tone he likes best and which it will be his aim to reproduce on future occasions. He will find that prints which come out of the toning bath, looking bright and vigorous, will often after being fixed looked flat and weak, whilst those which look hopelessly dark and over-exposed, turn out, when finished, to be capital prints full of vigour and brightness. He will also find that some of the toning formulæ given will give better results if the picture is

not printed too deeply, and this is notably the case with the borax bath.

Some samples of ready-sensitised paper are rendered much more amenable to the action of the toning-bath by immersing them in a weak solution of common washing soda in water, after the free nitrate of silver has been washed away.

It is a great disappointment to the printer if, after spending much time and trouble upon a batch of pictures, he finds that several of them are marked, especially at the corners, with insensitive spots, which have refused to tone at all, and which preserve the brick-red colour common to untoned prints. These blemishes are due to impure fingers. Let the careful operator make it a rule not to tone when he has been messing with other chemicals. Let him constantly rinse his hands before touching the prints, and be most careful to use one particular dish for toning, and for nothing else. A good dish for the purpose is one made of *papier-maché*, of such a size that several prints can be put in it side by side at a time. I say side by side, for prints, while being toned, should on no account be allowed to lap one over the other. This is a fruitful source of irregular toning. The prints, too, should be kept in movement. They may be made to change places by sliding one over the other, and occasionally the tray or dish in which they are placed can be rocked so as to send the solution in a wave from end to end. If these precautions be carefully attended to, the operation of toning prints, in which so many

beginners fail, is sure to succeed. The operator should have near him, whilst he is toning, a large pan of clean water. As each print is toned it should be removed to this water, and kept there until all the pictures are ready for the next and final stage. The blank space caused by the removal of one picture can be immediately filled up by a fresh one, and the contrast between the red untoned paper, and that which has been under operation for some minutes in the toning bath, is a great help to the worker in judging of the depth of colour obtained. When in doubt as to whether a print is fully toned, it can be held up to the light. Should any red remain in the print, it can be well seen when the semi-transparent paper is looked through, in which case the print must be returned to the toning bath.

It will probably be found somewhat difficult to judge of the colour of prints by the red light of the dark room, so that it is advisable to conduct the toning operations by weak daylight.

It should be remembered, however, that the paper is still more or less sensitive to light until it has passed through the fixing bath.

CHAPTER X.

FIXING AND WASHING THE PRINTS.

In fixing prints, that is to say, in dissolving out those portions of the silver compound which have not been utilised in making the picture, the same salt is used which is employed to fix the negative on glass. Hyposulphite of soda, which was first put to this use by the famous astronomer, Sir J. Herschell, is at once the photographer's friend if it be used in its right place, and his deadly enemy if a small portion of it only should find itself where not required. For this reason, be careful that all the paraphernalia connected with the previous work of toning is jealously put away before the hypo comes upon the scene.

Hyposulphite of Soda	½ lb.
Warm Water	1 quart.
Liq. Ammonia	1 dr.

I recommend warm water to be used, because the solution of the soda crystals is hastened, and also because their liquefaction causes the water to be so chilled, that in a few minutes it is reduced to the temperature of the air. If cold water be used to begin with, the temperature falls many degrees, and it is always as well in using different solutions that they should be at equal temperatures. The ammonia

is added to correct any acidity which may be present.

When the soda crystals are thoroughly dissolved, the prints are taken one by one and immersed in the solution. A deep dish should be used for this purpose, and the prints should be kept moving as much as possible so as to allow the soda to act equally upon each. When all the prints are in the dish, the bottom one can be easily removed, and put on the top, then the next one the same, and so on until all have changed places. After fifteen minutes of this treatment the pictures will be fixed.

Unfortunately, it is far more easy to give the pictures their quantum of hypo than it is to remove the hypo after its work is done; and unless every trace of it is removed the pictures will most surely fade. To wash the prints by hand is the most effectual method, if it be properly done, but it is certainly tedious work. As the beginner will probably have only two or three dozen to wash at a time, he may adopt the following simple plan. Employ two large round earthenware pans, such as are used in dairies. Fill one of these with water. Take each print out of the fixing bath, and put it direct into this pan. When all the prints are thus transferred allow them to soak for five minutes, then carefully pour off the water, leaving the prints at the bottom. Fill up again, leave ten minutes, then take each print separately, and remove to the other pan, also filled with water. The two pans can now be employed alternately thus:—No. 1, we will say, is full with the prints floating

in it. Let them soak for half-an-hour. Empty away the water, so that the prints form a mass at the bottom of the pan. Prop up the pan on its side, so as to drain away the last drop. Now fill up once more, and, after another half-hour, transfer the prints to No. 2 pan. Go through the same procedure again, and in a few hours the prints will have been thoroughly freed from hypo. The business, no doubt, seems to the reader to be tedious enough, but other work can be going on at the same time. One friend I have who combines gardening with the art of photography, and whilst he is attending to his flowers, two pans of photographs are frequently to be seen in the corner close to a drainage grating, and he attends also to these at short intervals.

Many ingenious contrivances have been introduced for the washing of prints, and small apparatus for the use of amateurs can be purchased, but most of them rely upon the system of constant change of water and occasional drainage, which method I trust I have made clear in my directions for washing by hand. The last mechanical washing apparatus that has been introduced (Fig. 18) I have seen in action, and it certainly seems to do its work remarkably well. It consists of an outer case of wood lined throughout with zinc. In this cistern, supported above the bottom, is a perforated cylindrical vessel to hold the prints. This as well as the cistern is kept full of water by the supply-pipe on the left-hand side, but the water is delivered in a particular

manner, to which the apparatus owes much of its efficiency. Two brass pipes, which will be noticed crossing the back of the box, are perforated with

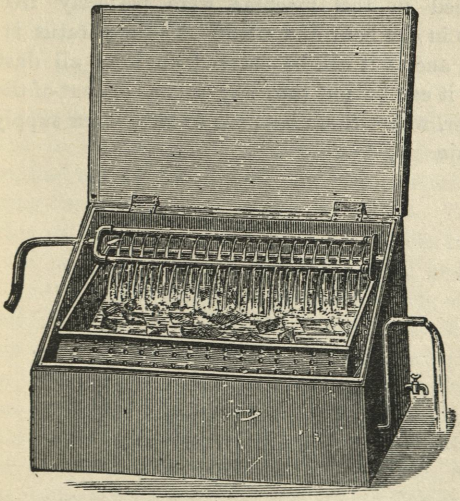


Fig. 18.—Photographic Print Washer.

numerous holes in such a manner, that the streams of water issuing from them strike the body of water below in such a direction as to cause a rotatory movement in the perforated container. The prints, therefore, while they remain in this washer keep up a continual dance, moving slowly round and round, up and over, but quite separate from one another. The pipe at the right-hand side carries away the waste from the bottom of the tank, to which the heavier soda-

charged particles of water fall, and the tap can be used to drain off the water entirely when required. A public analyst has certified that a batch of prints washed in this machine were perfectly freed of hypo in one hour and a-half. The apparatus is compact, and as it can be covered up from all dust and dirt, it can be put into any cellar, or out-of-the-way corner, where there happens to be a water supply and a drain.

CHAPTER XI.

MOUNTING PHOTOGRAPHIC PRINTS.

MANY people who have got over the various difficulties involved in photographic work to their entire satisfaction, find a great trouble in the final operation of mounting the pictorial results of their efforts. Either the print will not stick to the card, or it sticks in one place and not in another, or it gets lopsided and out of the centre, or it wrinkles, or does something else of a provoking character. Let the reader follow the directions here given, and these difficulties shall disappear. First now, with regard to mounting pictures in the centre of the cards destined to receive them. This can be done without even marking the card with the faintest pencil line to guide the eye; indeed, it can be done quite mechanically by the simple device now to be described.

Procure a sheet of stout cardboard the size of the largest mounting board which you are likely to require, for the contrivance you are about to make from it is a gauge to last you for all time, and to serve for mounting pictures of any size within a certain limit. This limit is governed by the size of the sheet of cardboard you now take in hand. Find its centre by drawing lines from corner to corner, and from this centre carefully draw lines at half-inch

intervals, as shown in Fig. 19. This is your gauge, and its use is as follows. Take the trimmed print that is to be mounted, lay it face downwards on a sheet of glass, and apply the mounting medium with a stiff brush. Now raise it from the glass with the point of a knife, and transfer it, still face downwards,

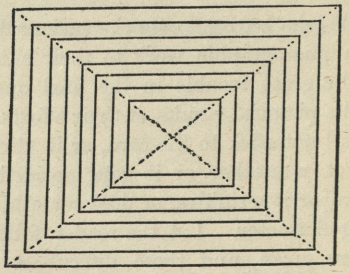


Fig. 19.—Mounting Gauge.

to the centre of your gauge. You are sure to find some lines thereon which will agree very closely with the size of your picture, and only a trifling manipulation will be needed to centre it to those lines as nearly as possible. Now take your mounting cardboard, having previously ascertained which lines on the gauge card it agrees with in size. Placing one edge of the mount on the line in question, which may be marked with pencil for ready identification, carefully and slowly bend the mount down on the print. The sticky side of the latter being upwards, it immediately sticks to the card. The mount is now removed, laid on its back, and the print gently smoothed down

upon it with a handkerchief. The same principle can, of course, be applied to mounting prints in an album, it being only necessary to procure a gauge the exact size of the book, and to insert it between the leaves when required. If the work be carefully done, the prints must of necessity be in the centre of the mounts.

Of the various compounds for sticking photographs on their fixed supports starch is most commonly used, and if made fresh for every batch of pictures mounted, perhaps nothing can be better. In hot weather starch, like flour-paste, quickly undergoes a change which would certainly be prejudicial to the prints mounted with it. To make the starch, proceed as follows:—Put a tablespoonful of the best starch in a gallipot which has previously been warmed with boiling water. Add to this two tablespoonsful of warm (not hot) water, and stir until all lumpiness disappears. Now fill up the pot with boiling water, stirring all the time until the starch thickens. When this change occurs, add a few drops more water, and the starch is ready for use.

Many photographers use glue to mount their prints, and it has the advantage of not cockling the mounts as starch does, but it is so tenacious that it is far more difficult to use. It is, too, somewhat troublesome to make. But this last difficulty is obviated by using the glue powder which can be bought at most oil-shops. This need only be mixed with a little hot water, and it is ready for use.

Another method of using glue is to make it up into a solution with spirit, and to keep it in a wide-

mouthed bottle, which must be placed in hot water, to melt the contents, before use. I have often used this mixture; it is not difficult to manage if the gauge plan be adopted. It certainly does not cause the mounting-board to cockle. To make this mountant, take four ounces of best glue, and soak it in water until it swells to double its former size and becomes quite flexible; then melt it in a large pot, standing in a saucepan of boiling water, with frequent stirrings. Now, add very gradually, in small doses, half a pint of methylated spirit, stirring between each addition; strain through muslin, and bottle off for use.

Before mounting, the prints should be trimmed; that is to say, their rough edges and unprinted margins must be removed. This I prefer to do before toning, for then the prints are flat and easy to manipulate. After they are fixed and dried, they generally roll up and are difficult to handle. A sheet of plate-glass should be provided to cut upon, and a cutting-glass, the size of the prints to be trimmed, is placed above the pictures during the work. The best knife to use is a sixpenny shoemaker's knife, which will require frequent application to a hone. The object of using a glass cutting-gauge is, that the details of the picture can be seen through it, and the edges of the print can be cut parallel to any straight lines it contains. Another reason for trimming the prints at the stage recommended is, that they are ready for mounting before being actually dry. This is a great advantage if starch be used, for, otherwise the prints must be laid between layers of damp blotting-paper

before the starch is applied to their backs. Cutting-glasses for all the regular sizes of photographic prints, with bevelled edges, can be bought at the shops; but a bit of plain glass—a spoilt negative may be stripped for the purpose—answers well enough provided its angles are true.

A novel method of mounting photographs was demonstrated some time ago by Mr. Cowan before one of the photographic societies. It presents great advantages both in rapidity and absence of cockling, but it requires the possession of a rolling-press.

The prints, when taken from their last washing-water, are placed in a heap on a sheet of glass, which is reared on end so as to allow the water to drain from them. When they are free from surface water, each print is raised from the mass, and receives a coating of starch-paste. The starched prints are now put on canvas-covered frames to dry, the frames being supported a few inches apart, one above another, so as to economise room and to keep the pictures free from dust. When the prints are dry, the mounting-boards are placed in a pile near at hand, and the top one is slightly damped with a sponge and clean water. Upon this mount a print is carefully centred, its dried, starched back resting upon the damped surface of the card. The two are now put between the rollers of the press—which, by the way, are nickel-plated, so as to avoid all risk of rust—the handle is turned, and the now-mounted print comes out at the other side of the press so firmly fixed in its place that it cannot be removed without tearing.

CHAPTER XII.

PRINTING WITH PLATINUM.

THE process of printing with salts of silver must be regarded as, at present, the standard process for producing photographic pictures on paper. The results to be obtained by it—providing a really first-class negative is employed in the printing-frame—are most beautiful, and both in vigour and tone leave nothing to be desired. But there is something more required in a valued picture, and that is permanence. Silver prints have always had to bear the charge of want of stability, and there are few households which do not own certain sickly, yellow, ghost-like pictures which represent the remains of what were once brilliant photographs. If all the operations comprised under the heads of printing, toning, fixing, and washing be honestly done, and good chemicals be used, I believe that a silver print is really permanent, if it be kept unmounted. Certain it is that the uncertainty creeps in directly the print is mounted on card. The paste may be sour, or compounded of materials which will re-act upon the picture; or the mounting-board may, in the course of manufacture, have been treated with chemicals which will act in the same disastrous fashion. I have never known one of my unmounted pictures to alter in the least after some years' keeping,

but I cannot say the same of those which have been mounted on card in the usual way.

But, of late years, a totally new method of photographic printing has been introduced, which is not only undoubtedly permanent but has several advantages in other ways. In this new method, which is known as the "platinotype process," a salt of the metal platinum instead of silver, is employed. Among the advantages claimed for it are the following: The prepared paper is so sensitive to light that on a dull day pictures can be produced with ease; if tested against silver prints, the time occupied in printing one picture in silver would give at least three in platinum. The manipulations are exceedingly simple; the toning, fixing, and prolonged washing necessary in the older process being entirely done away with.

The paper is supplied by the Platinotype Company in a damp-proof covering; for dampness—even that moisture which is constantly present in the driest atmosphere—is very prejudicial to its sensitive surface. For this reason, the paper is kept by the user in a tin tube, which contains some chloride of calcium to absorb any moisture that may be present. Even the joint of this calcium tube, where the lid meets the body of the box, should be covered over with an india-rubber ring to keep out the enemy. Not only must the paper be dry, but the printing-frame must be the same, and also the negative. When the paper is placed on the negative, it should be backed up with a pad of blotting-paper, freshly dried before a fire and this should be covered with a piece of india-

rubber cloth. With such precautions, the amateur need not fear failure from damp; but he must take similar precautions after the paper leaves the frame. It should be instantly returned to the calcium tube until all the prints are ready for further treatment. As very complete instructions are furnished to purchasers of materials for platinum printing, it will only be necessary here to describe in a general manner this interesting process.

The paper, as received from the makers, is, on its sensitive side, of a lemon-yellow colour. In the printing-frame this colour does not become dark red, as in the case of silver-printing; but it turns a kind of drab, the picture, when even fully exposed, having only a ghost-like form. It is during development that the true strength of the picture becomes apparent. This development is effected by dipping the print into a warm bath, containing 130 grains of oxalate of potassium to each ounce of water, the solution being kept at a temperature of 170° Fahr. This may be considered as the normal heat; but in cases of under-exposure it can be increased, and, under certain circumstances, decreased. In order to ensure the correct temperature, the development takes place in an iron enamelled dish, furnished with a thermometer, and heated below by a spirit-lamp or Bunsen burner.

The exposed paper is carefully immersed in this hot bath, so as to avoid bubbles. With a little practice this is easily done, and, if the exposure has been correctly timed, the operation of developing is complete in from five to ten seconds. Directly the

surface of the paper touches the solution, the hitherto feeble picture seems to flash out at once in all needful strength. This is apt to deceive the beginner, and he will perhaps withdraw the print before development is really complete. Seven seconds, or thereabouts, may be looked upon as the usual time to leave the prints in the dish.

After removal from the developing solution, the prints are transferred successively to three baths, each containing a very weak solution of hydrochloric acid in water; a rinse in three changes of plain water completes the work.

Platinotype prints are quite different in appearance to the usual pictures on albumenized silver paper. To begin with, they have a dull, or matt, surface, and the tone of the picture is like that of an engraving. Artists much prefer platinum prints to silver prints, as being more artistic, and it is only owing to the circumstance that the general public prefer something bright and shiny for their money that the new form of permanent picture does not make greater headway. Still, those who practice the process are constantly increasing in number, and there is no doubt whatever that people will gradually be taught to appreciate better than they do now its beautiful results. There is certainly one thing which keeps the process back, and that is its expense when compared with silver printing. Metallic platinum has recently, chiefly owing to the demand for it for electrical purposes, risen in price to such an extent that now it is almost as costly as gold, and at present there is no

sign that it will fall. Many will think that the extra expense is more than covered by the wonderful saving of time, to say nothing of the non-necessity for the costly gold toning-bath. A negative that will yield a good silver print will give a good one in platinum; and very often a very dense negative, from which a really satisfactory silver picture is difficult to obtain without a terribly long exposure to daylight, will, without trouble, yield a beautiful print in platinum. The process, from the rapidity of all the operations, is one most suitable to the amateur, whose photographic work is necessarily taken up only occasionally.

The Platinotype Company are now issuing more than one description of sensitised paper, but the foregoing remarks refer to that which is of the familiar black tone. The pictures printed by its aid form the bulk of those shown at the Photographic Exhibitions, the colour of the print being dense engraving—black; indeed, it is not too much to say that several of the portraits printed on this kind of platinotype paper look at first sight exactly like engravings, and it is difficult in some cases to believe that they are the product of the camera. Especially is this the case when the print is mounted on cardboard with a plate mark, in which case it has still more the appearance referred to. The Company are now issuing a description of paper which, when finished, affords a sepia tone, and most excellent work has been done with it. The following directions given by the Company will show that certain precautions are necessary when the paper is employed. Speaking generally, the method of

using the paper is the same as that already described; but it must be understood that the sepia paper being more susceptible to faint light, the greatest care must be taken in examining the paper during the operation of printing. Although there may be no perceptible change by this access of faint light, the whites of the picture become to a certain extent degraded—an effect which renders itself unpleasantly visible after the picture is finished. The developing solution used is the same as that for the black paper, but it must have added to it one or two drachms of a special solution which is supplied for the purpose, and the temperature for the developing bath must be maintained at from 150° to 160° Fahr. If, in spite of all care in preserving the paper from accidental gleams of light, there should be a discoloration of the white portions of the prints, this may be due to want of sufficient special solution in the developer, or it may indicate that the paper has been kept too long, that the dish in which the development is conducted has its enamel chipped so that the iron is exposed, or that too much light has reached the developing solution. After use, the developing bath must be kept in the dark, and it must be specially noticed that this same bath must be reserved entirely for the sepia paper: that is to say, it must not be used for black prints.

The acid clearing bath should consist of one part of hydrochloric acid to sixty of water, and this operation should be conducted in very weak light; for, unlike the black paper, the sepia prints may be affected by light while in this stage of their manipulation. Two

more precautions may be added here which will prevent disappointment in the use of either the black or the sepia paper. The same developing dish should on no account be used for the two, and the black and sepia prints must not be cleared or washed together in the same vessel.

It has been pointed out by Mr. Ralph W. Robinson that a warmer tone can be obtained with the ordinary black platinotype paper—a discovery which he seems to have found out by accident. He had been printing from a number of unvarnished negatives, and he found that the prints from those which had been intensified with mercury yielded a warmer tone than ordinary, and he believed that a certain amount of the mercury salt on the negative had affected the paper beneath in the printing frame. He therefore tried whether he could not modify the tone of the prints by adding a small quantity of mercuric chloride to the developing solution; and he found that he obtained the result sought for when he added one drachm of the mercury salt to ten ounces of developer. He also found that the tones could be considerably varied by the quantity of mercuric chloride employed.

The platinotype process has also recently been modified by Mr. Willis, its inventor, by the introduction of what is called the cold bath process, which many persons seem to prefer to the hot bath method already described. In this case the platinum salt instead of being contained in the paper is absorbed by the paper during development according to the amount of light the paper has on different parts received. A

specially prepared developing salt is supplied for working this process; and this, after being dissolved in water, with a small portion of platinum salt, forms a developing liquid. Unfortunately, it does not remain good for any long period, and so it is economical to use as small a portion as possible at a time. In the case of large prints, development may be brought about by applying the solution to the paper with a large flat brush.

The platinum process has been very much simplified by Captain Pizzighelli, who has shown how paper may be prepared which will give a visible and gradually darkening image in the printing frame. This process is the result of a great many experiments, and the principle of the method is the introduction into the sensitising solution of a reducing agent. In using this paper the exposure can be gauged just the same as in the case of ordinary silver albuminised paper, and development either by hot or cold process is totally avoided. The paper, when the exposure is deemed to be sufficient, is simply taken from the printing frame and is immersed first in acid water, and then in warm water.

This chapter would be incomplete without an allusion to certain processes which have been lately introduced, and have been successfully used, in which platinum is employed for the toning of ordinary silver prints: that is to say, on either "matt surface" paper or on the commom albuminised paper. Mr. Valentine Blanchard, a well-known veteran photographic worker, prepares a specially "matt surface" paper, and

issues with it a developer in two solutions; these have merely to be mixed with a certain portion of water, and used to develop the prints. The effect gained is in every respect equal to that produced by the original platinum process, but it is not quite certain that it will give equal permanence. This is a matter that can only be determined by time.

Mr. C. L. Clark has given a great deal of attention to this subject of platinum toning of silver prints, and the process which he has published is very largely used by amateurs. The results given are excellent, and a variety of tones are obtainable by modifying the method of working. The solution that he uses consists of—

Chloro-platinite of potassium, 1 part.
Water ... ... 250 parts.

This solution has sufficient nitric acid added to it to turn litmus paper perfectly red. After the print has been washed in plain water as usual before toning, to get rid of the free nitrate of silver, it is laid down on its face, on a sheet of glass, upon which has been poured a small quantity of the above toning solution. This is better than using a larger quantity of fluid and flooding the print in the ordinary way, because this solution quickly loses its virtue, and it need hardly be pointed out again that the platinum is a very expensive item. Two ounces spread out in the manner mentioned, either upon a sheet of glass, or upon the bottom of a porcelain dish, will be sufficient to tone a 15 × 12 picture, or, if preferred. the solution can be

brushed on to the print without any fear of hard lines being left across the picture. But this operation must take place while the paper is wet, and directly after it has been taken from the washing water. The toning process is exceedingly quick and satisfactory, and those who have found difficulties, as many do with the old gold formulæ, are advised to try this one, which is easier in practice, and which at the same time promises greater permanence.

Amateurs may be glad to know of a convenient process for obtaining a rough proof of any negative while away from home which does not involve the use of any chemical solution whatever. This process is not due to platinum, but may be conveniently mentioned in this place. The prints obtained are bright blue in colour : in fact, the chemicals employed for sensitising the paper form the well-known pigment called Prussian blue—so called not from any compliment to our German friends, but because the principal salt used is prussiate of potash. It is hardly advisable for the amateur to prepare the paper for himself, for it is cheap enough to buy, and is far better thus obtained than it can be made by inexperienced hands. It is known as ferro-prussiate paper, and is very much used by architects and engineers for reproduction of their plans and drawings. It is only necessary to place a sheet of this paper beneath such a plan or drawing on tracing-cloth or tracing-paper in a printing frame, and to expose it to light for a certain time. Developing is brought about by simple immersion of the paper in tepid water. Prints from

photographic negatives can be obtained in precisely the same way, but it should be noted that the process is so slow in action that a day for printing should be chosen when the sun is shining brightly, and the printing frame should be exposed to its direct rays; hence the time of exposure will vary greatly with the time of year; for the intensity of a June sun is very different to that of the sun later in the year. Thin negatives make the best prints, and under favourable conditions a print can be obtained in about twenty minutes. Late in the year an exposure of some hours may be necessary to produce the same result. It is difficult to tell exactly when a print by this process is sufficiently exposed; this is a matter of experience.

When the print is taken out of the frame it is immersed face downwards in a basin of tepid water, and in about ten minutes is complete, and the print can be rapidly dried between a couple of folds of blotting-paper. As already indicated, the process is most convenient for obtaining rough proofs—quick memoranda, as it were, of negatives which have been taken away from home. It may be mentioned too that certain subjects—sky effects over the sea especially—printed in this medium bear a very good resemblance to moonlight effects.

CHAPTER XIII.

ON PHOTOGRAPHING BY FLASH LIGHT.

THE brilliant light emitted by igniting the metal magnesium was utilised about twenty-five years ago for photographic purposes; but the use of the metal in this way was merely experimental and suggestive, for at that time magnesium was regarded as quite one of the rare metals, and its price was excessive. Moreover, there were not then many amateur photographers who cared to interest themselves in any experimental work. Since that time the effect of the burning metal has become well known through its employment in fireworks, and pyrotechnists have often complained that those who have once witnessed its great brilliancy are apt to expect a great deal more of it for their money than it is practicable to give them. The value of the metal for photography is due to the highly actinic light which it gives: a light which is much more active for photographic purposes than that given by incandescent lime. Indeed, if one cared to try the experiment, it would be found that double the effect can be gained by the instantaneous ignition of a mere pinch of magnesium powder than could be gained by the use of a lime-light for several minutes. Of late years the production of magnesium has been considerably cheapened, so that instead of costing fifteen

shillings an ounce, it can now be obtained in the form of a powder for about one-seventh of that amount.

It is the custom to take what are called flash light portraits at night, but there is another use for magnesium powder which is often lost sight of, and that is its employment during dull days as an aid to daylight. Some few photographers have been in the habit of using magnesium in this manner, and they have recorded that it is extremely valuable in the case of children's portraits, which must be taken with as short an exposure as possible. The effect, too, of a portrait taken by this double light is generally better than one taken at night: for the reason that the model or sitter is not so blinded by the sudden appearance of the magnesium flash.

There are many ways in which magnesium can be utilised for this flash light purpose. It can be mixed with some pyrotechnic compound: such, for instance, as that which is commonly used to make Bengal lights. Here is a formula :—

Saltpetre	1 ounce
Sulphur	½ ounce.
Antimony-sulphide	¼ ounce.

This is a common formula for the white light known as Bengal fire, and by adding to it, say, a quarter of an ounce of magnesium powder, we have a mixture which will give an intensely actinic light. I should be inclined to recommend such a mixture as this merely for occasional work, say for the illumination of caves or other underground places where

daylight does not penetrate ; but for employment in a room such a mixture would be very inconvenient and disagreeable in action, on account of the heavy sulphurous fumes given off.

The operator must be cautioned against certain formulæ for flash light mixtures which contain, in addition to magnesium powder, chlorate of potash allied with sulphur, or any compound of sulphur ; for directly the chlorate comes in contact with the sulphur or any of its compounds, an explosive mixture of terrible potency is formed. The chlorate is harmless enough by itself if carefully handled ; but in order to show how dangerous it is in companionship with sulphur, the experiment may be tried of placing a grain or two of each substance in a dry mortar, and then, with the face carefully averted from the mouth of the vessel, rubbing down the mixture with the pestle, a series of small explosions will presently follow, showing clearly enough that the mixture is not safe even to handle. Chlorate of potash, indeed, forms, curiously enough, an explosive mixture with magnesium alone, as the following experiment will show. Powder a little of the chlorate, and place a small heap of it in a fender or in some situation where it will do no harm, and attempt to light it with a match ; the greatest difficulty will be found in causing it to burn at all, though one or two sparks may be coaxed out of it as the burning match touches the powder. Now place a similar little pile of the powdered metal by itself, and attempt in the same way to ignite it with a match ; it will slowly burn through,

with very little flame or light. Next mix a small quantity of these two agents together—and it must be a very small quantity, or mischief will result—apply a light to them by means of a burning taper held at the end of a stick, and it will be found that the mixture of these two apparently harmless agents forms an explosive which is quite as powerful, if not more powerful, than gunpowder.

It will be seen, therefore, that it is best to avoid any mixture of ingredients which are liable to lead to accident, and from which, I may mention in passing, fatal accidents have already occurred. Luckily, the maximum actinic effect can be obtained from the magnesium powder without any such dangerous admixture.

Some ten years ago, for instance, Captain Colomb designed a lamp for flash signalling for use in the navy; the lamp in outward appearance was an ordinary lantern, but it had a special form of lamp within it. This lamp was furnished with a double reservoir: the upper part filled with spirit for feeding the spirit flame in the ordinary way, and the lower one containing an inflammable powder, composed of resin, lycopodium, and magnesium dust. A couple of tubes proceeded from this lower reservoir, and pointed above towards the flame. This powder chamber had attached to it an india-rubber tube, the end of which was furnished with a mouth-piece; the lantern was hung up, let us suppose, in the rigging of a ship, and the operator, by blowing through this tube for a long or short period, could produce a long or short blind-

ing flash as the powder was blown into the spirit flame. But such an apparatus as this is merely mentioned in order to show that a brilliant effect can be produced from comparatively harmless material; but it will presently be seen that the metal alone is sufficient to fulfil all the requirements of the photographer, and as we have already seen that it can only be inflamed in a mass with the greatest difficulty, it will be seen that its use can hardly be attended by danger.

When the use of flash lights for photography was revived, now two or three years back, one of the first methods suggested, and which came into common use, was to place a small tuft of gun-cotton on an iron tray or plate, and to sprinkle above it a few grains of the magnesium dust. When the cotton was ignited it flashed off with slight explosion, and inflamed the metal dust which was entangled in its meshes. This plan is effective, but it must be noted that the gun-cotton itself does very little towards the work except in igniting the magnesium powder, and scattering it in a cloud. In itself, it gives a yellow tone to the flame, which cannot be of any photographic service. The gun-cotton must be of the right kind—that is, it must be of the explosive variety and freshly prepared, and its explosion should be so quick that when a little is laid on the hand and ignited no heat should be felt, nor should there be any residue or ash left behind.

But on the whole, I prefer to deal with magnesium powder alone, and to employ some flame such as that given by burning spirit or gas to yield the necessary

ignition; and whatever be the form of apparatus used in igniting the powder, it should be of such a kind that it will scatter the powder in the air so as to leave a space between each suspended particle. A very simple form of magnesium flash lamp was suggested a short time ago in an American paper, and it will serve to illustrate the form which such apparatus should assume. It consisted merely of a clay pipe with a wide bore, around the bowl of which was tied with wire a little cotton-wool or tow. The other end of the pipe had fastened to it an india-rubber tube and mouth-piece, of such a length that it could be held at a respectful distance from the face. The way in which this simple apparatus was used was as follows:—The bowl of the pipe was charged with about fifteen grains of magnesium dust, and a few drops of methylated spirit were poured on the cotton or tow surrounding the outside of the bowl, and ignited. A puff of air through the tube attached to the pipe-stem would send the magnesium dust flying from the bowl in a cloud, and it would immediately take fire, from the burning spirit round about it. It is easy enough for the amateur who has a little ingenuity to design for himself some kind of flash lamp which follows this principle. There are now sold many cheap forms of spirit stoves, the design of which is to boil an egg or a kettle for the comfort of bachelors, and such a stove may easily form the basis of a flash lamp arrangement: for we merely want some kind of tube arrangement pointing to the flame and charged with magnesium dust, which can be projected into the flame at the required moment. It

is impossible here to notice the various forms of magnesium flash lamps which have been brought out, but they generally act on the principle now described. One, however, works in a slightly different way, and is the invention of Mr. Leisk. This lamp has an

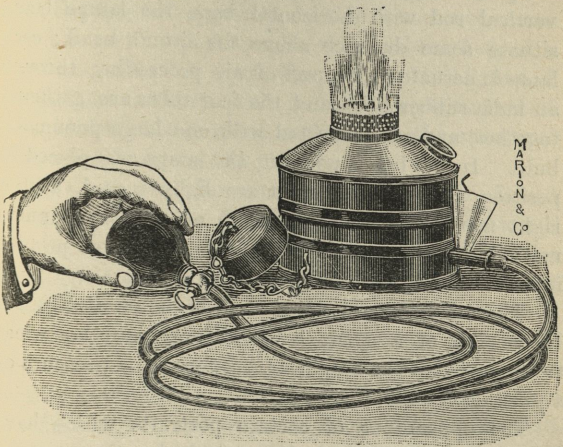


Fig. 20.

annular wick of asbestos, about two inches in diameter, the asbestos being soaked in methylated spirit and ignited. In the annular space there is a little table, upon which the magnesium powder is placed. The touch of a spring causes this table to revolve, with the result that the powder is scattered by centrifugal force into the surrounding wall of flame, and gives a blinding flash of light. But whatever be the form of lamp used to get satisfactory results, two

or three lamps should be employed in concert. Messrs. Marion have lately introduced a system by which very fine portraits have been taken by the adoption of this principle. As many as four lamps are placed on a special form of stand, consisting of a vertical rod with horizontal bars, the lamps being situate some distance above the sitter's head; each lamp is actuated by a puff of air proceeding through an india-rubber tube, and the four tubes are gathered together, and are connected with one large pneumatic bulb. In taking a portrait, the lamps are placed in position, their spirit flames are lighted, and, at the right moment, a simple squeeze of this large pneumatic bulb will send a stream of magnesium powder into each flame simultaneously.

The form of spirit lamp used is shown at Fig. 20. It consists of a spirit lamp with an annular wick, through which the magnesium is forced by pressure of a pneumatic ball.

The appearance of certain portraits which have been taken by means of a flash lamp are quite enough to deter amateurs from attempting this class of work, because some of these are most unnatural in appearance. Other portraits, on the other hand, one could not tell from those taken by daylight in the ordinary manner. The difference between the two is simply the result of careless management, or the reverse. If we want to get the best results we must employ, as already shown, three or four different sources of light, and the sitters should be instructed not to look toward the lens; for to the look of

the eyes may generally be traced the unnatural appearance of the face. The reason is not far to seek; the eyes at night-time in the comparative darkness of an ordinarily lighted room have their pupils much expanded, and this enlarged pupil when photographed gives the face an appearance which we are not accustomed to see in a photograph. The sudden flash of a light, too, will often cause the sitter to blink, and if the flash be not very quick indeed, the movement of the eyelid is photographed, and adds to the unnatural effect already referred to.

To summarise this matter, the amateur is advised to use at least two flash lights, one on either side of the sitter, and at some height above his head—to fire these lights at the same moment by taking care that the apparatus by which they are discharged is common to both. Care must be taken by the use of a shade against each lamp that the flame does not shine directly towards or into the lens. The development of a flash light photograph requires some slight modification. The pyro should be kept back, and the full dose of ammonia should be added at the outset; for in all such photographs there is a tendency to very white and black contrasts, and this can only be avoided by the use of plenty of the ammonia, or other alkali, employed at the outset.

CHAPTER XIV.

COLOUR SENSITIVE OR ISOCHROMATIC PLATES.

It has always been urged against photography that it is untruthful in its translation of coloured objects, and up to recent times it must be acknowledged that the charge was a well-grounded one. If we were to try the experiment of photographing a coloured picture by the ordinary gelatine process, we should find the following result: the reds and the yellows would be represented in the negative by almost clear glass, and therefore they would print in the positive perfectly black; while the blues and colours approaching to blue would be white. But suppose that an engraver was given a coloured picture—as in the past an engraver has often had to do—to translate into black and white: surely he would not represent the reds and the yellows as black, nor would he express a deep blue sky by white; he would give each its "tint," as an engraver calls any particular tone which he obtains by the juxtaposition of fine or coarse lines. The blue he would express as a grey, the yellow he would translate more nearly approaching to white—in order to give the same luminous impression which that colour has to the eye—and the reds would also be represented by grey, having more or less depth, according to the intensity of colour. It is very clear, then, that ordinary photography will not do this.

Again, suppose that we had to photograph a bunch of sunflowers in a blue vase—to take an extreme instance. In the resulting photograph the flowers would appear black, and their containing vessel would appear white; and it need hardly be pointed out that such a condition of things would be contrary to nature or truth. It is a matter of every-day remark that a person with yellow, red, or auburn hair will be represented in the photograph as if he possessed locks of raven hue; and a person whose face is covered with freckles presents an appearance in the resulting negative that no photographer would dare to show his clients without a plentiful amount of *re-touching*: that is to say, the freckles on the negative would be represented each by a patch of clear glass, and those marks must be filled in by the re-touching lead pencil before such a negative could possibly be printed from.

Lately, however, it has been discovered that by the use of certain agents added to the silver emulsion with which the plates are spread such plates can be made to a great extent so sensitive to certain colours that those colours are presented in a photograph with their true tone relation to one another—that is to say, as an engraver would express them. Certain dyes are used for this purpose, and it is possible to dip an ordinary gelatine plate in a solution prepared from one of them in order to make it sensitive to colour in the sense stated. But few amateur photographers will care—unless they be of an experimental turn of mind—to attempt to prepare plates in this way for themselves; for such preparation entails special arrange-

ments, not the least of which is a dark cupboard in which the plate so treated can be dried before being used in the camera. Such plates, too, very quickly deteriorate; but the difficulty of preparing plates at home need not deter the amateur from their use or prevent him enjoying the advantages which they offer, because colour sensitive plates of first-rate quality are now to be obtained commercially. These are sometimes called "orthochromatic" and sometimes "isochromatic." Both terms are unsatisfactory, the first meaning right colour, and the second equal colour. It is evident that neither term gives the exact definition required. The plates obtainable in this country are sold by Messrs. Edwards, of Hackney, who have the exclusive right of manufacture, under certain patents, and these plates will be found to be of very fine quality indeed. At various exhibitions throughout the country it has been the fashion of late years to exhibit pictures of certain coloured objects taken with isochromatic plates, and by their side pictures of the same objects taken with ordinary plates, and the difference between the two is most remarkable. Turning to one that I happen to have before me, it represents a bunch of yellow calceolarias in a light green vase, together with some dark purple heartsease. In the ordinary photograph the heartsease are light and the calceolarias are black, but in the isochromatic picture the colours appear in their true tone relations to one another.

Isochromatic plates—as prepared by Messrs. Edwards — have the advantage of extreme rapidity,

besides that of rendering colours more as they appear in nature than do ordinary plates; they are therefore suitable for use in hand cameras, and the great advantage of their use is seen in photographs which are taken late in the evening. It will be found that when such a plate is used a great deal more detail is obtainable than from an ordinary plate. Another advantage in using isochromatic plates is found in the greater detail that is obtainable in clouded skies. In an ordinary negative clouded skies are too frequently represented by dead black, which of course prints perfectly white in the positive, with the result that a sky from another negative has to be printed in in order to give the picture a natural appearance. If isochromatic plates are used, the clouds generally appear on the one negative, and I need hardly say are far more satisfactory than if printed in in the way described.

For certain subjects it is necessary to use a yellow screen in conjunction with these plates, the screen being made either of yellow glass which has been optically worked on both sides so that its two faces are perfectly parallel, and can be fitted either in front of the lens or at its back inside the camera; or a thin transparent yellow medium can be obtained by treating gelatine with aurine solution, and inserting a screen made in this way in the diaphragm slot of the lens. This yellow screen should not be used for landscape work unless there is much blue haze present; in which case it will add marvellously to the correct rendering of the distant portion of the view. The use

of this yellow screen of course affects the amount of exposure required, and it may be taken, generally speaking, that when used the exposure must be tripled. The use of the yellow screen is also necessary when the copying of a painting is undertaken. I may as well here record an experiment which I tried, and by which I obtained an isochromatic result on an ordinary plate. I wished to copy a large oil painting—a family portrait—the subject being that of a lady with a red velvet dress and a red rose in her hair, with green leaves, the whole picture being yellowed and very much cracked with age, for it was exhibited at the Royal Academy about fifty years ago. This picture I had set up in the open air on a winter's afternoon, and I photographed it under the very red light of the setting sun, giving a prolonged exposure, and using a very small stop in my lens. The result is in every respect as if I had used an isochromatic plate, and it is difficult to believe that I could have obtained a better result under any circumstances whatever. I publish this experience because it shows the value for certain subjects of the yellow screen; but in this case I did not find it necessary to use one, for Nature provided me with one ready-made in the golden sunlight of that winter afternoon.

An isochromatic plate being, as already described, sensitive to the yellow and red rays of light, it follows that the greatest care must be exercised in its manipulation. A red lamp or window which is perfectly safe for the manipulation of ordinary plates will often inevitably fog those which are of the isochromatic type.

It therefore becomes necessary to work with a light which is of a much deeper ruby tint than that ordinarily used, with the further precaution that the developing dish must remain covered as much as possible during the necessary operations. These precautions may perhaps frighten some from touching isochromatic plates, for they may fancy that they will be troublesome in use. But this is not the case; the paucity of light in the dark room is more than counterbalanced by the excellent result obtained; and although the advantages in ordinary landscape work may not at first be apparent, nor will a very great difference often be found between a negative taken by an isochromatic plate and one prepared in the ordinary way, yet when the two plates are printed, the positive from the isochromatic plate will be found far more rich in gradation and tone values than the other. It seems, too, that with a small quantity of pyro *density* is more easily obtainable by an isochromatic plate than it is upon one of the ordinary kind. Development is the same as in the ordinary case, but I advise the use of dry pyro in preference to that which is mixed with a preservative.

CHAPTER XV.

PRODUCTION OF TRANSPARENCIES FOR LANTERN SLIDES, ETC.

A VERY beautiful application of photography is the production of positive images on glass for window decoration, but more especially for slides for the optical lantern. Before the advent of photography, the pictures for this latter purpose were drawn and coloured on the glass by hand. Some of the finest things ever produced in this way were painted some thirty years ago for the old Polytechnic Institution, London, and I believe that in some cases as much as £20 was paid for a single picture. Their size was about eight inches by five. But directly photography came to be applied to the same purpose, with its wondrous command of detail, the standard size became reduced to three-and-a-quarter inches square, and the most beautiful effects were at once attainable at a fraction of the former expense.

Although the amateur can never hope to compete with those whose business it is to exhibit lantern pictures fifteen or eighteen feet in diameter, still he can, by means of the very efficient lanterns burning paraffin oil, which are easily managed, cause endless delight to himself and his friends, by exhibiting on a screen large reproductions of the scenes which he has

visited, or life-sized portraits of friends known to all his circle. The work of producing positives on glass from his negatives is best carried on by gas or lamp-light, and can well occupy the long winter evenings when other photographic work is at a standstill. I hold the belief that no one has observed all the beauties of a good photograph until it is exhibited by the aid of the lantern, and I fancy that most people will, when they have practically tried the question, be of the same opinion.

Glass positives, $3\frac{1}{4}$ by $3\frac{1}{4}$, can be taken in the camera, or direct from the negative by contact in a printing frame. The first plan is necessary when the negative is so large that it has to be reduced to the standard lantern size. But if the operator has produced his pictures with a quarter-plate camera, or even a 5 by 4, the contact plan can be adopted. We will now consider both methods in detail.

In copying a negative by daylight, a room, if possible, should be chosen for the work the window of which affords an uninterrupted view of the sky, without the intervention of trees or buildings. Such a room can generally be found, even in London, at the top of the house. Upon a table in front of the window place a lidless box, in the bottom of which is cut a hole the size of the negative to be copied. (*See* Fig. 21.) The said negative may be placed therein, or it can be fixed against the window pane with brown paper pasted all round it. The varnished side of the glass must be towards the room. Exactly opposite the negative, and so placed that the lens is at the same height as

its centre, is placed an ordinary camera, the dark slide of which is fitted with a carrier to take a $3\frac{1}{4}$ by $3\frac{1}{4}$ plate. The most suitable lens to use is a short focus, portable-symmetrical; but others can be ap-

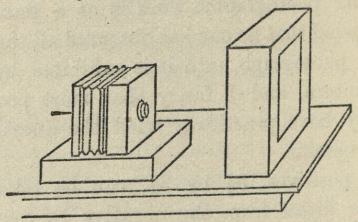


Fig. 21.—Arrangement for Copying a Negative in the Camera.

plied to the purpose. There are so many lantern plates now in the market that it would be invidious to name any one brand in particular for selection. But it is a *sine quâ non* that for this copying in the camera the plate must be of the bromide variety—not chloride.

The negative must be carefully focussed on the ground-glass screen of the camera. The exposure on a bright day, and with a normal negative and the above-named lens, using No. 4 stop, will be about half a minute. If, however, the negative is unusually dense, or yellow in colour, it will take much longer. A great difference in exposure will also be necessary, according to the method by which the original negative has been developed. If by the ferrous-oxalate plan, the exposure will be little more than half that required if the negative owes its existence to pyro. After exposure the plate is developed by the ferrous-oxalate method, using an

extra quantity of bromide. It must be allowed to develope until it appears darker than intended to be when finished. The usual operations of fixing and washing are then proceeded with. A slight opalescent veil, due to the lime in the water which manifests itself on a plate developed by this method, I have already adverted to in the chapter on developing. This, of no detriment to a negative image, is far from being the case where a lantern picture is concerned. It must be got rid of, or it will give the picture by transmitted light a sickly yellow colour. This can be readily done after the picture is fixed and washed.

Dissolve in a cup half an ounce of bicarbonate of soda, with three ounces of water. Add to this gradually sufficient citric acid in powder to neutralise the alkali, and to leave the solution slightly acid to litmus paper. Immerse the picture in this liquid, and rub it lightly at the same time with a cotton-wool pad soaked with the same. In a minute or two the lights of the picture will be as clear as glass. The picture is then washed in one or two changes of water, and dried. If properly exposed it will require no intensifying, for the density will be quite sufficient without it. If, however, intensification is needed, it can be done by one of the formulæ already given. When daylight, for want of opportunity, is not available, gas-light can be used to illuminate the negative to be copied. To do this to the best advantage, enclose a broad bats-wing burner in a tin box properly ventilated, and place some distance in front of it a piece of ground-glass. About an inch

in front of this must be placed the open box holding the negative. The various operations of focussing and exposure can then proceed, but naturally the latter will be prolonged to double or treble the time required in daylight.

Where the negative is already of a suitable size for reproduction as a lantern slide, the difficulties of the matter are very much lessened. In this case gas-light is a far better medium for impressing the plate than daylight, for it is under such ready control. Here we require a good bats-wing burner in easy reach of the hand. It is turned down as low as possible, except at the moment of exposure. The negative is placed in a printing frame, just as if a silver print on paper were about to be taken from it. Upon it, a gelatine plate, measuring $3\frac{1}{4}$ by $3\frac{1}{4}$, is carefully placed. By holding up the negative to the red lamp, the exact place for getting the most effective picture on the sensitive plate can be well judged. The back of the frame must next be put in its place, taking great care in doing so that the plate underneath is not shifted, and the whole arrangement is now ready for exposure to light.

Now hold up the frame at a distance of about 2 feet from the gas-bracket, and turn up the light for one second, or thereabouts. This exposure is for a good negative, and will be found suitable for most plates. With more rapid plates the exposure must be greatly reduced, or, what comes to the same thing, the distance between the frame and the gas-lamp must be increased.

And here the reader may be reminded of a well-known law, which is stated at length in all books on optics, but which may with advantage be briefly quoted here. "*The intensity of illumination on a given surface is inversely as the square of its distance from the source of light.*" To put the matter more plainly, let us suppose that we hold our printing frame at a distance of one foot from the gas lamp for one second, and that it is exposed double as long as it ought to be. In ignorance of the above-stated law, we might be inclined to double the distance in our next attempt, in the fond belief that the plate would then receive one half of its previous exposure. But the law teaches us that if the plate received a given amount of light at a distance of 1 foot, at 2 feet it will receive only one-fourth, at 3 feet only one ninth, and at 4 feet only one-sixteenth. This law, the application of which is soon understood, should be continually in the operator's mind when he is manufacturing lantern slides by gas-light. With a very thin negative a good positive can often be produced by increasing the distance from the source of light, and increasing the exposure accordingly. After exposure the plates are developed, fixed, and washed, just as if they were negatives, and in due time are placed in racks to dry.

CHAPTER XVI.

MAKING ENLARGEMENTS.

THE gelatine process, which has so simplified the practice of photography for amateur workers, has also come to their aid by suggesting an easy means by which their small negatives can be made into large positives. From a really good negative—and no other kind is worth the trouble—a picture enlarged up to ten diameters can be produced, which will be found well worth framing. For this particular purpose the gelatine emulsion is spread upon paper, instead of the usual glass support; but there are so many real difficulties to be overcome in the process that I would strongly dissuade amateurs from attempting to make the material for themselves. It can be bought at a reasonable price, and perhaps cheaper in the end than the amateur worker could produce it for himself.

Where quarter-plate negatives only are to be dealt with, the simplest and quickest plan is to use the negative as a lantern slide, and by means of one of the lanterns now sold, which burn mineral oil (*see* Fig. 22), he can project the image of the negative on any flat surface, such as a drawing-board covered with white paper and supported on a wall. The negative must have its film side away from the light, when the image will be projected on the board in its correct

position. If the negative be turned the other way, the picture will be reversed, as if it were viewed by means of a looking-glass.

The image having been most carefully focussed, and the lamp burning at its best, the lantern lens is covered with a cap, but not before the limits of the picture have been roughly marked out in pencil on the board. This marking is to assist the operator in

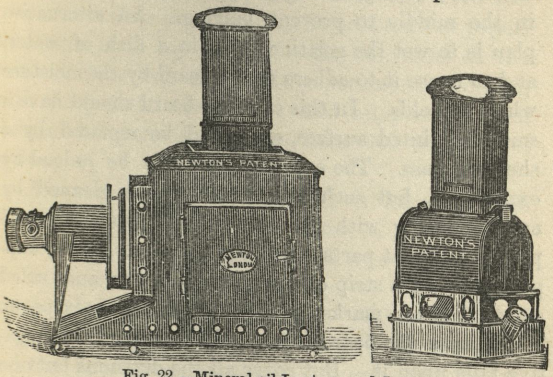


Fig. 22.—Mineral-oil Lantern and Lamp.

fastening the gelatine paper in the right position, so that the image will fall upon it, and not beyond its edge. The following operations are conducted by the light of the red lamp. A sheet of paper of the right size is taken from the cardboard box in which it is supplied by the manufacturers, and carefully unrolled with clean dry hands. Its sensitised side will be found innermost, and the best plan of procedure is to take it direct to the drawing-board,

upon which the image was just now focussed, and placing its free edge against the topmost pencil-marks to pin both corners there (drawing-pins can be used, but I much prefer steel pins about one inch long, with black bead heads, such as can be bought at the linen-drapers. They are much easier to handle in the dark). The sheet is now unrolled, and its bottom edges pinned also; it may, if large, require a pin on either side in the middle to prevent bulging. An alternative plan is to wet the gelatine paper in a dish of water, and to cause it to adhere to the board by the moisture which it holds. In this case the board should have a smooth painted surface, or should be replaced by a sheet of glass. The exposure can only be judged by experience, but such experience can be gleaned by experimenting with narrow strips of paper, and exposing different parts for different times. Thus, suppose we took a strip of the gelatine paper, and ruled across it pencil marks, so as to divide it into six parts. Pin this on the board so that the image of the negative falls upon it. But cover all the divisions but one with a shield of orange paper. Expose for one minute, now move your shield to the next division for another half minute, and so on until the last division has had its half minute of exposure. You can now note in pencil on the divisions the various exposures they have had, the last one being half, the next—one, the next—one-and-a-half, and so on. Now develope the strip, and you will see which division has had the correct amount of light. As a rough guide, I may mention that a good negative enlarged from 3¼ inches

to 12 inches will require an exposure of about two minutes.

The Argentic paper is manufactured by Messrs. Morgan and Kidd, of Richmond, and is sold in various sizes and quantities. Full directions for development accompany each roll of paper, but in the main the methods used are identical with those already recommended for plates. Although both the pyro and oxalate processes may be adopted for paper, the latter is, in my opinion, by far the better of the two. I have had some little experience in working with the material: for I have used up, principally in lecture demonstrations, more than 600 square feet of it.

After exposure, the paper, if it has not been already wetted, is soaked in water in a large dish. The water must be made to flow all over it, and a pad of cotton-wool, a piece of sponge, or clean fingers, can be used to help in the work. When the paper lies quite limp and soft, the water is poured away, and the developer is applied. (A good dish for the purpose can be made of wood, and painted with two or three coats of oil-colour, or covered with some waterproof material. Another good plan is to use a square of mackintosh cloth, tacked loosely to a frame of wood.)

Unless a wasteful quantity of developer be applied, the dish must be rocked, so that the developer moves uniformly over the surface. The image will soon appear, and the action must be stopped by pouring off the developer and rinsing two or three times with

water before quite sufficient density is obtained; for the image gains in strength when the fixing agent is applied. The paper must now soak in hypo and water—using plenty of liquid—and when fixation is complete, which can be judged by looking through the print at a gas-flame, it must be washed in many changes of water. A slight yellow tinge, which the paper receives from the iron developer, is afterwards removed by very dilute sulphuric acid. The strength of this solution, and other details of the process, can be gleaned from the published directions accompanying the paper.

In the absence of a proper magic-lantern, the amateur can, if he is gifted with constructive powers, make a simple contrivance for himself; that is to

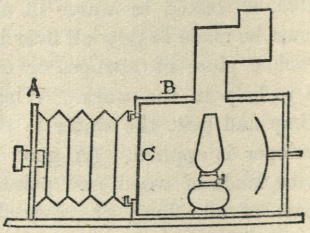


Fig. 23.—Section of Enlarging Lantern.

say, if he can handle a few tools intelligently. The lantern body may be made out of a small packing-case, with a door fixed on to where the lid should be. The case will stand on its side, and its general arrangement of parts can be understood by reference to the sectional drawing (Fig. 23). The

box stands on a base-board double its own length, and in front of it is an upright piece of wood, A, in which is fixed the lens. A is connected with the box B by a bellows. This bellows can be easily made, or a sleeve of black material, with hoops of brass wire inside at frequent intervals, and india-rubber bands outside to keep the hoops in position, may be used. A good paraffin lamp, or Argand gas-burner, can be used as the illuminant, with a silvered concave reflector behind it, fixed on a rod projecting at the back of the box for easy adjustment. The roof of the box should be covered round the hole for the chimney with tin-plate. In front of the box is an aperture, filled in with a sheet of ground-glass, and in front of this again are grooves, top and bottom, to hold the negative to be enlarged. The image is received on a screen, as already described; but the exposure will be longer than with a lantern possessing condensing lenses behind the negative, as in the ordinary magic-lantern arrangement. The form of the chimney is quite immaterial, so long as it possesses a bend to keep in the light from the lamp within. A foot of ordinary stove-pipe, with an elbow-joint, would answer the purpose admirably.

Those who have time and opportunity to work by daylight can do their enlarging without even such simple arrangements as those just described; and I think that the intelligent reader, having noticed the principle upon which the apparatus must be based will have no difficulty in contriving the means to admit the light from an ordinary window to serve his

purpose. If he have command of an upper window, giving an uninterrupted view of sky, his work will be simplified. First of all, nail two laths across the window, to hold an ordinary printing-frame the size of the negative to be copied. Place the negative therein, and secure with pins, for the back of the frame must be taken out. Now cover up the remainder of the window with brown paper, so that the only light coming into the room from the outside is through the negative itself. The bellows arrangement, or an ordinary camera, can now be supported on a shelf in front of the negative, and the view can be focussed and dealt with as already described.

Where several enlarged positive copies of a particular negative are desired, it is best to make an enlarged negative to print from in the ordinary manner. There are two methods of doing this. In the first place, we can obtain a transparency by contact, as detailed in the chapter dealing with that branch of photography; then, by means of the enlarging apparatus, we can get an enlarged negative from that positive. The alternative method—and the best, I think—is to get the enlarged positive first, then touch it up with Indian ink, if required. Now wax the positive by laying it on the top of a hot plate—the top of the kitchen-oven, for instance—and rubbing it all over with a hot iron, with a lump of white wax running before it as it moves. A piece of clean blotting-paper laid above it, and another application of the iron, will remove superfluous wax. With such a prepared positive to work from, a negative may

be readily obtained by contact in an ordinary printing-frame on albumenized paper. This negative is in its turn coated with wax, and as many positives as desired can be printed from it.

CHAPTER XVII.

ABOUT EXPOSURES.

From what has been already said, it will be gleaned that one of the most important things, if not the most important thing in taking a photograph, is that the gelatine plate should receive its proper amount of exposure to the action of the light. The various sized stops or diaphragms furnished with the lens will most probably form at first a problem to the beginner. He will not know what to do with them. For this reason he has been already advised to use a medium-sized stop, and to use that only until he has had plenty of practice with it. He will soon find out for himself that a picture taken without a stop, *i.e.*, with the full aperture of the lens, is not nearly so sharp as one taken with a stop inserted in the slit provided for it. He will also discover that this insertion of a stop necessitates a prolonged exposure. As experience is gradually acquired, and experiments are tried on different subjects with different stops, their value will become apparent. Let us suppose, by way of example, that it is desired to photograph a mass of white flowers, mingled with dark green leaves. If we operate with a large stop upon a model having such violent contrasts of light and shade, the resulting negative will show the white petals as masses of

impenetrable over-exposure; while the green leaves will be represented by almost bare glass. But now let us try the same picture, but with the very smallest stop of our lens. We shall now gain a very different result, and with ordinary care in development, the white petals will bear pearly shades as in the original, and the dark leaves will have also some semblance to reality.

Modern lenses are made with stops having a definite relation one to the other, and as a broad rule, it may be stated, that a given stop being used, the next size smaller will require double the exposure. Or let us put it in this way. Take the example of the flower study given above, and let us suppose that the exposure with the smallest stop, as recommended, has been one minute. Using the next size larger, the exposure would be half a minute; the next stop to that would be 15 seconds; then with the next $7\frac{1}{2}$ seconds, until we arrive at the largest stop, with which the exposure would be a trifle over 3 seconds.

But, as indicated in the chapter on landscape photography, the amount of exposure is dependent in a very great measure upon the subject of the picture in hand, or rather, upon the amount of light reflected by the different objects composing that picture. It is possible to make out a table showing the relative exposures necessary for different objects, and such tables have been published; but, at the best, they are only approximately correct, for all such calculations must be modified by the quality as well as by the quantity of light at disposal. Mr. W. K. Burton gives the

following comparative exposures for different subjects with a medium-sized stop.

Sea and Sky.	Open Landscape.	Landscape with heavy foliage in fore-ground.	Under trees, up to	
			Mins.	Secs.
$\frac{1}{10}$ sec.	$\frac{1}{3}$ sec.	2 secs.	2	40

Fairly lighted Interiors.		Badly lighted Interiors, up to		Portraits in diffused light out of doors.	Portraits in ordinary room.	
Mins.	Secs.	Hours.	Mins.		Mins.	Secs.
2	40	0	32	$2\frac{2}{3}$ secs.	1	4

To show how these figures can be affected by the value of daylight at different hours of the day, and seasons of the year, the following table is appended. It is compiled by Dr. I. A. Scott.

TABLE OF COMPARATIVE EXPOSURES.

Hour of Day. A.M.	P.M.	June.	May July.	April Aug.	Mar. Sept.	Feb. Oct.	Jan. Nov.	Dec.
12		1	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$3\frac{1}{2}$	4
11	1	1	1	$1\frac{1}{4}$	$1\frac{1}{3}$	$2\frac{1}{2}$	$4\frac{3}{4}$	5
10	2	1	1	$1\frac{1}{4}$	$1\frac{3}{4}$	3	5	6
9	3	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	4	12	16
8	4	$1\frac{1}{2}$	$1\frac{1}{2}$	2	3	10	—	—
7	5	2	$2\frac{1}{2}$	3	6	—	—	—
6	6	$2\frac{1}{2}$	3	6	—	—	—	—
5	7	5	6	—	—	—	—	—
4	8	12	—	—	—	—	—	—

These figures will be affected, especially in our changeable English climate, by variations in the state

of the atmosphere, and in the *colour* of the light. For example, if a picture were taken in the yellow light of a sinking sun, the exposure might be doubled or trebled with advantage. Again, in London, and large towns where smoke abatement is being constantly preached and never practised, there is always more or less a yellow mist hanging above the houses. This, of course, necessitates longer exposure. But even in the country, the atmosphere, especially in the early morning, holds a yellow mist, suspended too far above ground to be readily noticeable, but which is very apt to make the itinerant photographer guilty of under exposure. Let us sum up this matter with the conclusion that the photographer must use his head, as well as his hands. Knowing that the stop which he is about to use has given him good results with a different class of subject, and, perhaps, at a different time of day, and season of the year, he ought to be able, by aid of the tables given, to judge what exposure he will now want. But let him look around him first, and see whether there are not local features which must be also taken into account.

CHAPTER XVIII.

FILM NEGATIVES.

FIFTY years have passed since Fox Talbot first began to use paper as a support for the negative images in the collotype process. The introduction of the collodion process in 1851, substituted glass for paper, and now, curiously enough, everyone is thinking of relinquishing glass and once again utilising paper in the production of negatives.

Those who have been accustomed to read the technical journals, or who would take the trouble to look through back volumes, would soon discover that the question of substituting for glass some less brittle and less heavy material as a support for the photographic image, is one which has cropped up with periodical persistence. Indeed, we may go so far as to say that in principle, the various methods now advocated for making and using paper films, were described and practised by experimental workers many years back. For example, in 1871, Mr. Woodbury published a process which was as follows:—A piece of plate glass, of any convenient size, was rubbed over with powdered talc, and was then coated with a mixture of collodion, castor oil, and Canada balsam. After this mixture had set, it was flowed over with a solution of gum. When this was dry, the surface

was covered with any suitable emulsion, and the film was stripped from the glass, cut into convenient sizes, and stowed away for use in the camera. It is interesting to note that Mr. Woodbury concludes his description of the process with the following words :—

"I have, some time ago, called attention to the great advantage of making long bands of such films, and exposing them, panoramic fashion, in a suitable slide, to avoid all the bother and trouble of changing the plates."

About five years after this process was published, Warnerke introduced his roller-slide commercially. This slide consisted of a dark back containing two rollers, which were charged with a long band of paper coated with collodion emulsion. Sufficient of this band was reeled off from one roller to serve for one exposure, then the other roller received the exposed portion, and another length was unrolled, a tiny electric bell giving a warning sound when a certain length of the paper had been unwound.

Shortly after the revolution in the photographic world, caused by the advent of gelatine plates, Messrs. Morgan and Kidd introduced their gelatine-bromide paper, and, although its real use was for positive printing, and more especially for enlarging purposes, many excellent negatives were produced by using it in place of an ordinary gelatine plate in the camera.

Until last year, this use of films and paper negatives was little more than experimental. The reason for this was that although most people were alive to

the advantages of having a negative which will not break, which is but a fraction of the weight of glass, and which can be stored in very small space, its production was difficult because of the unsuitableness of existing apparatus. This difficulty vanished when the Eastman Dry Plate and Film Company showed, at the recent Inventions Exhibition, their roll-holder, or roller-slide, and specimens of the very beautiful results obtained upon the dry films manufactured by them. This proof of what could be done in the way of film photography acted as a spur to our English manufacturers, and now most of the dealers in photographic apparatus are turning their attention to roller-slides, conceived originally, as we have seen, by the late Mr. Woodbury.

Before describing the Eastman Company's apparatus and the method of employing it, it may be well to point out some of the advantages of paper films. First of all, the weight of material for more than one hundred film pictures is not more than that of one dozen glass plates. This is not only a very great gain to the tourist photographer, but it bears upon the important point of cost of carriage. Next we may notice, that films are absolutely free from the vice of halation. In pictures of interiors, the windows are generally fogged out of existence by this halation, which is due to reflection from the back of the glass upon which the negative is taken. This cannot occur with a paper negative. The paper negative can be retouched on either side; clouds can be put in with a stump; weak places can be strengthened; and the

whole can be manipulated in a way quite impossible in the case of glass. Very effective combination pictures can be made by cutting out figures, etc., from one negative, with a pair of scissors, and inserting them into landscape negatives, furnished with corresponding openings for their reception. Such are some of the advantages to be found in the use of paper films, which have the further great merit of being cheaper than glass plates of equal size.

Paper films can be purchased either in long bands, for use with roller slides, or cut into the usual photographic sizes, for use in the ordinary dark slides. We will consider the latter first, as being the simpler. It is presumed, also, that the careful worker would first try a few sheets of paper supplied in that way before altering his existing apparatus to suit it to the roller slide. It is obvious that a flexible material, such as paper, must have some kind of rigid support to keep it flat in the ordinary dark slide, which has been constructed for the use of glass plates only. The following plan will be found well adapted for first experiments. Take a sheet of glass the size of the dark slide, a waste negative plate which has been treated with very dilute sulphuric acid to remove the film will naturally suggest itself. Warm it well before the fire, and at the same time heat three strips of diachylon plaster, one inch in width, and corresponding in length with the breadth of the glass plate. Now press the hot plaster strips on the glass plate, one in the centre, and one at each end. Continuing the heat, gradually raise and tear off the slips of

plaster, so that plenty of the sticky composition is left adhering to the glass. This is your support for the pieces of paper film. Make the film adhere by gentle pressure to the adhesive surface of the glass plate, and then treat it in every way as if it were an ordinary gelatine plate. Another plan is to give the edge of the glass a coating of gelatine and glycerine, but we prefer the method just described.

The Eastman Company have devised a film carrier for the ordinary dark slide, which dispenses with any

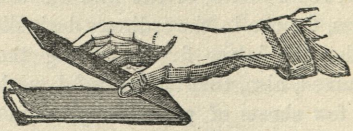


Fig. 24.

adhesive material, and has the merit of being much lighter than a sheet of glass of the same size would be. It consists of a thin piece of board made up of different strips glued together to prevent warping. Over this board fits a metallic rim, and between the two, gripped at its edge firmly by the movable rim, lies the sheet of sensitive paper. In putting the paper into position, the metal rim is laid flat on a clean surface (as shown at Fig 24), the cut sheet is laid within it, and then the wooden back is inserted with sufficient pressure to grip the edges of the paper between the wood and the metal.

The Eastman roll-holder, although agreeing in principle with previous inventions, is very different

in detail—indeed, it may be said that it is to the extreme perfection of this detail, and to the forethought which has provided for all possible contingencies, that the commercial success of the contrivance is chiefly due. The plan of making all the parts of the apparatus interchangeable is a characteristic feature of American inventions, which producers on this side of the Atlantic would do well

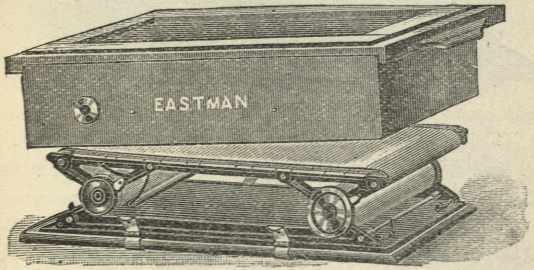


Fig. 25.

to copy. The different parts are machine-made, and are of first-class workmanship.

The most noticeable feature in the Eastman roll-holder, and the one in which it most differs from previous contrivances of the kind, is the manner in which the paper band is adjusted in its place. In so-called roller-slides of the old pattern, the rollers were fixed, and the paper had to be carefully wound upon one of them before use. In the Eastman slide, the negative paper is already wound on independent spools, which can be slipped into their place and

adjusted ready for use in a few seconds. A spool of unsensitised paper is sent out with each holder, so that the operator can accustom himself to working the holder in the broad light of day. When he is thus made familiar with the necessary operations, he

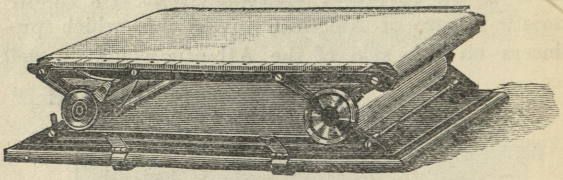


Fig. 26.

can safely trust himself to repeat them in the subdued light of his dark room.

Fig. 25 shows the roll-holder with its outer case partially removed. Beneath are the feeding and

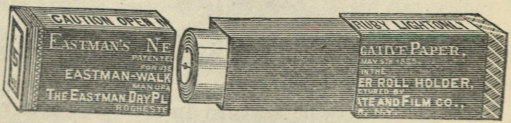


Fig. 27.

receiving rollers, for the unexposed and the exposed portion of the film respectively. On the left-hand side of the case will be seen a round opening. This is for the reception of a winding key, which acts upon the roller within. At every revolution of the roller an alarm sounds, and the operator knows that for

every length of paper he must turn the key through four revolutions. Fig. 26 shows the outer case wholly removed; and Fig. 27 represents the spool of sensitised paper as it is sent out by the company, in a light-tight case, ready for insertion in the roll-holder. Each spool contains sufficient length of band for twenty-four exposures. The roll-holder, superseding the existing dark slides, can be fitted at slight expense to any camera.

Those who have been accustomed to work ordinary gelatine dry plates will find little difficulty in developing the Eastman paper. After exposure, the band is cut into lengths, the place for cutting being indicated automatically by a pin, with which the band is perforated every time the alarm has sounded. Thus every fourth perforation will mark the place where the band must be separated. First of all, the piece of paper to be developed is immersed in water, until quite limp; at the same time it is brushed with a soft camel-hair pencil, to remove any adherent air-bells. It is now put in the dish, and flowed over with the developer, particulars of which can be obtained from the Company. The negative while still wet is squeezed to a rigid support consisting of either a sheet of glass or ebonite which has been polished with powdered talc. When quite dry the paper is easily stripped from this temporary support, and can be printed from at once. But if speed is an object, the printing process is rendered much quicker by the application of vaseline oil, which makes the negative translucent.

Although the introduction of this paper negative material marks an undoubted advance in Photography, it must be admitted that it is far from perfect. If the exposure be either less or more than the right amount, a slight grain becomes visible in the prints—the grain, that is, of the paper upon which the negative rests. This grain becomes less apparent when the negative is oiled as described, but still it is an objectionable feature of the process. To obviate this defect the Eastman Company have since introduced their stripping films, upon which negatives can be produced which are in every respect equal to those taken on glass plates. In one respect, at least, such negatives are superior. In glass negatives, where a strong light comes against a shadow—the brightly illuminated window in a dark church for instance—a glare is produced which very often entirely mars the effect of an otherwise perfect picture. This is known as *halation*, and is caused by reflection from the back of the glass upon which the negative image rests. This fault in film negatives is altogether absent, for the reason that there is no reflecting surface to produce it. The American stripping film differs from that which preceded it in the circumstance that its paper backing is only a temporary accommodation; during exposure in the camera it serves the purpose of a support, and enables the film to be used in the roll holder, but it is subsequently discarded. This is brought about by the intervention of a layer of soluble gelatine between the paper and the gelatinous *insoluble* film upon which the photographic image is

impressed. After development, the film is attached to a fresh sheet of thick gelatine, and the temporary paper backing is stripped off and thrown away. There is no doubt that in this process the tedious washing process is reduced to a minimum, for first of all the surface of the picture is well washed, and after its support is stripped from it its back is also accessible to the cleansing action of the water. In this way the hypo and other objectionable foreign salts are speedily removed from the negative picture.

But paper films of all kinds are now likely to be altogether superseded by another material, the introduction of which, for dry-plate work, marks an era in the history of photography ; and were it not that the apparatus used for paper-work still holds its own under the new conditions, the last few pages of this book might have been eliminated. The new material referred to is called celluloid.

Celluloid of a kind was introduced, and actually proposed as a suitable support for the photographic film, a very short time after glass had been suggested and adopted for the same work. It is a compound similar to gun-cotton or pyroxyline, although in outward appearance it is different, being formed by the action of nitric and sulphuric acids upon cotton, paper, or other form of cellulose. It is then mixed with camphor and certain solvents, and can be moulded like wax to take any form. Its first name was Parkesine (after Parkes, its inventor) ; the chief manufacturers of it in this country are the British Xylonite Company, in North London.

The delay in the adoption of celluloid for photographic purposes is due to the circumstance that it is soluble in the same media—alcohol and ether—which are used in collodion, which is simply a compound of pyroxyline with those solvents, so that as long as the wet (collodion) process held the field, celluloid as a support to the film could not be employed, although it had actually been suggested. But it is probable that the difficulty would have been surmounted by interposing between the celluloid and the collodion an insoluble gelatinous coating—if the material had presented sufficient inducements to warrant its adoption. But this was evidently not the case. It did well enough as a substitute for ivory in the manufacture of knife-handles, piano-keys, etc.—when mixed with a white pigment—and was largely used instead of horn for combs, paper-knives, and other fancy articles. But when it was attempted to produce thin sheets of the material, and to rival glass in its transparency, it was found that the result was yellow in colour and uneven in surface. So the material, so far as photography is concerned, was lost sight of until the year 1889, when from America came prepared gelatine films supported on thin celluloid as white, and nearly as transparent, as glass. English plate-makers took up the material, but were, and we believe are, dependent still upon the Americans for the celluloid basis.

A celluloid sheet has the appearance of very white horn, which is perfectly smooth and glass-like on one side, and is dull on the other side. It is on this mat or slightly dulled surface that the material is coated

with gelatine emulsion to fit it for photographic uses. It is supplied by the dealers cut up into sheets of the usual stock—camera sizes ; or is supplied, of a much thinner kind, by the Eastman Company in spools ready fitted for their roll-holder, already described.

We will consider the treatment of the cut sheets in the first place, as most probably the reader will obtain a few pieces of celluloid in this form before he decides to relinquish the use of glass. Celluloid, with all its advantages, has the demerit of being much more expensive than glass ; and until it is cheapened it cannot really compete with the older material. The price for the smaller sizes of films is at present more than double the price of glass plates. Their extreme thinness, when compared with glass, makes the films unsuitable for use in ordinary double backs, unless they are backed with sheets of thick cardboard. Without this support, the springs on the metallic division plate in the slide would bulge out the centre of each film and throw it out of focus. Exposure is the same as for glass plates, and any good developing formula may be used. But it should be noted that if ammonia be used to force an under-exposed film, fog is likely to occur. It would be therefore better when under-exposure is suspected to use a developer which employs soda or potash, instead of ammonia, for its alkali.

The difficulties with the films which will be experienced by those who have been accustomed to glass plates are merely of a mechanical kind, and will soon

be surmounted. Supposing that we are about to develop one, we remove it from the double back, place it film side upwards in a *deep* developing dish, and, as a preliminary operation, allow water from a tap to stream copiously upon it while we hold it to the bottom of the dish with the fingers. It will stick there when it has been thus held for a few seconds, when the water can be poured off, and the developer take its place. The development must be carried on until the deposit is apparently denser than is desirable in the case of a glass plate, or it is likely to appear thin after fixing. Then comes the washing, the immersion in alum, and the final fixing in hypo. Take care that whenever the film is immersed in one of these solutions, it be pressed down once for all to the bottom of the dish, otherwise it will float to the surface, and the chemical action will be unequal. The Eastman Company have introduced a modified form of developing dish which dispenses with the necessity of touching the film during the operation. The novelty consists of two pieces of wood which are inserted along two opposite edges of the dish after the film has been placed therein, and which hold it rigidly against the bottom. By cutting two pieces of flat whalebone to the proper length, the same principle might be applied to any other dish with vertical sides. After fixing and washing—which latter operation is best performed in a washer with vertical grooves—the films are pressed between two layers of clean blotting-paper, and suspended by the corner so that they hang vertically until dry. Each film should

then be varnished, and finally stored away in an envelope marked with its name and history. It is said that fourteen dozen such films weigh less than one dozen glass plates of the same size.

But the most perfect way of using celluloid is undoubtedly that which has been designed in such complete fashion by the Eastman Company—in the form of a flexible transparent film fitted to their roll-holder. The tourist photographer equipped with this contrivance fitted to a suitable camera, which need not be of small size, can undertake long walks without fatigue; for the weight he has been accustomed to has disappeared, and he can bring back with him a panorama of films, which only need to be cut into lengths before being developed into negatives. Celluloid should always be cut with scissors, for it is difficult to make an impression upon it with a knife.

CHAPTER XIX.

FAULTS AND THEIR REMEDIES, AND SOME USEFUL HINTS.

If plates are coated in warm weather, or if dried by too much heat—and sometimes from some unknown cause—they will blister or frill soon after the developer is applied to them. In some cases, the plates will show no sign of this most aggravating fault until put in the fixing-bath. In this latter case, dilute the bath with half its bulk of water. If they frill under development, try some of the following remedies:—Rub a composite candle all round the edge of the plate before wetting the film; mix with the developer 20 per cent. of methylated spirit; let the preliminary soaking of the plate take place in a strong solution of Epsom salts instead of plain water. In very obstinate cases, coat the plate with a layer of plain collodion, in the same way as when varnishing, before wetting it. N.B.—A large batch of plates which I made some time back frilled so badly that the film creased up and floated off the glass directly the developer was applied. I put aside these plates for three months, and found, on again taking them in hand, that the fault was entirely absent.

Wavy markings on a developed plate may generally be traced to dirty dishes or developing-cups. These should be rinsed out with a mop or brush kept

for the purpose, previous to developing each picture. The dark stain on both cups and dishes will readily yield to a little citric acid and water. Finger-stains can also be removed by the same harmless agent.

Spots on the plate are often due to dust in the dark slides or changing box. The remedy is obvious. Larger round spots, which look like clear glass in the finished negative, are the result of bubbles resting on the film during development. These seldom occur if the plate be soaked in water first of all, but, in some cases, the film is very repellant, and bubbles will come. A flat camel's-hair brush, moved over the film when first put in the developing-dish, will at once cure this evil.

The amount of bromide in the developer will require to be modified according to temperature. If in hot weather a given amount of bromide gives a good result, the quantity must be greatly reduced when the temperature is much lower.

Plates which are known to be under-exposed should be kept before development for some weeks, for it is a known fact that when once the film has been acted upon by light, a kind of continuing action will go on afterwards, although the plate be kept in absolute darkness. Travellers going abroad with the intention of not developing their plates until after their return home, should bear this fact in mind, and give a slightly shorter exposure than they would under ordinary circumstances.

In travelling always carry some ruby cloth or paper, for with it, in case of need, a band-box can in a

minute be turned into a red lamp. It will also do for daylight, when the larger part of an ordinary window has been filled in with common brown paper.

In the early days of alkaline development it was recommended that the developing dish should be kept still so as to prevent air getting to the surface of the plate, and so discolouring the pyro, but since preservatives have come into use, it has become the custom to rock the dish during development.

Glass-tubing can be bent in the flame of a spirit lamp, or Bunsen's burner. Approach the glass gradually to the flame from above, then turn it gently round and round, letting the flame play equally upon the part where the bend is to come. The glass will soon get soft, and can be bent as desired.

If the ground-glass screen of the camera be broken and cannot readily be replaced, white wax dissolved in ether and flowed over the surface of ordinary glass, will answer the purpose. White tissue paper gummed on glass, will do for a makeshift.

To get a fine grain on glass, rub two pieces together by placing one horizontally on a table, and moving the other in a circular direction upon it. Between the two put flour-emery, and water. In a few minutes both surfaces will be beautifully ground.

It is a good plan to fasten the lens-cap by a piece of strong twine to the brass mount, otherwise it is likely very soon to be lost. The screw for fastening the camera to the triangle may also be attached to the latter in the same way, and for the same reason.

In photographing the interior of churches, &c., where there is a smooth and somewhat slippery pavement, it is difficult to secure a firm foothold for the camera tripod. The difficulty can be obviated by three slices of wine-bottle cork to cover the points of the legs, and three yards of string to keep them equidistant.

The addition of a few drops of a very dilute solution of hyposulphite of soda (1 part soda to 200 water) to the ferrous-oxalate developer, will act as an accelerator, and will give increased density. It must, however, be used with great caution, or the plate will suffer beyond recovery.

The travelling photographer need not carry developing-dishes, if he will take with him a few sheets of parchment paper, such as jam pots are covered with, cut into pieces measuring two inches larger each way than his plates. These are readily made into dishes for temporary use by bending up the edges and holding the folded corners between American paper clips.

Plates are well packed for travelling by putting between each a little frame cut out of cardboard. The frame should be the same size as the glass plate, and should not measure more than one-eighth of an inch in width.

The iron triangle belonging to the tripod camera stand should have wash-leather neatly sewn over its limbs. This covering will protect the camera from scratches, if not from more serious injury.

If indoor portraiture be attempted, be careful that

the window of the room is specially cleaned for the purpose. A good mixture for cleaning glass is fine emery powder wetted with methylated spirit, with just a trace of liquid ammonia. A London window is really too dirty for portraiture two days after it has been cleaned.

Cheap dishes for home work may be made out of the common tin trays sold for baking purposes, but they should first have a good coating of Brunswick black. Apply this with a brush after well warming the metal.

To remove emulsion splashes and smears from the backs of plate, or from dishes, funnels, glass rods, &c., rub them with common kitchen salt moistened with water. A piece of flannel makes the best rubber.

The diaphragms or stops of many lenses are made to rotate and form part of the lens mount. Other lenses, which from their size cannot have this arrangement, are supplied with loose stops. It is a good plan to have these fastened together with a rivet or pin, like a set of ivory tablets sold for ladies' use. In a lens of this second description, the slit for the stops should be covered with an india-rubber band when the full aperture is used for instantaneous work, otherwise light is admitted which might fog a very sensitive plate.

It is a good plan to keep near the developing-sink a small box of powdered pumice-stone, and a piece of sponge. If the latter be moistened and dipped into the powder, it presents a ready means of

cleaning the backs of plates. It is the exception to find a plate which does not need some treatment of the kind.

Use freshly-mixed hyposulphite of soda for every batch of plates which are developed, if you want the best results. The salt is cheap enough to justify a little liberality in its use.

This precaution is not so necessary when negatives only are in question, but extra permanence may be assured by a second bath of clean hypo. Transparencies, however, should invariably be fixed in a freshly made solution.

As a general rule the camera should be kept during exposure as level as possible, but under certain circumstances it becomes necessary to tilt it up. Supposing, for instance, the subject of the picture is a high building, so situated that the photographer cannot place his camera as far away from it as he would wish to do. When focussed on the ground-glass screen of the camera, it is found that the upper part of the building is not in the picture. The camera must therefore be tilted up; but the result of this is to cause vertical lines to converge towards the top, a fault which can be corrected by restoring the plate to a vertical position by means of the swing back, with which all the best cameras are now provided.

It must be noted that all photographic formulæ are compounded by "Apothecaries' weight."

Litmus paper, both blue and red, is sold in small books. The former detects the least trace of acid in any liquid with which it is damped by turning red,

and the latter changes to blue on contact with an alkaline compound.

It is a matter of the first importance that the red light of the dark room, whether it consist of filtered day-light or lamp-light, is strictly non-actinic: by which is meant that the sensitive chemicals employed are not affected by it. Many of the lamps sold for this purpose are safe enough, unless very rapid plates are used. Lately a new medium has been introduced which is highly spoken of. It consists of a special green "cathedral glass" (to be obtained from most photographic dealers), backed up with two or three thicknesses of yellow paper. This medium admits plenty of light of a safe character.

A very efficient plate washer and drainer (see Fig. 28), has been recently introduced by Messrs. Marion. It is so arranged that plates left in it receive automatically a constant change of water. Placed under a slowly running tap, the tank is emptied by a self-acting syphon directly the water level rises to a certain height. It then refills, and the action is repeated for as long as the tank remains in the sink. The grooves in which the plates lie are twenty-four in number, and as they are fixed in a loose frame, it can be removed with the plates standing in position, so as to form a draining and drying rack.

In winter, the temperature of the water used for development should be not less than 60° Fahr. If the experiment be tried of developing two plates, one with ice cold water, and the other, which has received

the same exposure, with water at the temperature mentioned above, the following results may be noted. The cold developer will remain perhaps many minutes on the plate before an image is discernible, and the prolonged development will probably induce stains. With the warmed water, the operation will be com-

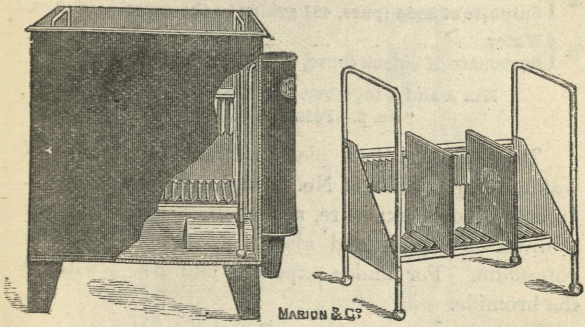


Fig. 28.

plete in the normal time, and a negative free from stains will be produced.

Mr. Beach's potash developer is one which has latterly been much in favour, especially among amateur workers. It gives wide latitude in exposure, and the resulting negatives are of such a black and white tone, that printing operations are much accelerated. The developer is mixed in the following manner :—

Warm, distilled or rain water	**4 oz.**
Sulphite of Soda (pure, 437 grains to the ounce)...	**4 oz.**

(when cold add)—

Sulphurous Acid	3¼ oz.
Pyro (one commercial ounce bottle)...	437 gr.

Label the above "No. 1.—Pyro Solution."

Now make two solutions as follows :—

A	Warm Water	4 oz.
	Sulphite of Soda (pure, 437 grains to the ounce) ...	2 oz.
B	Water	4 oz.
	Carbonate of Potash (pure, 437 grains to the ounce)	3 oz.

Mix A and B together, and label the mixture "No. 2.—Potash Solution."

To develop a half plate, add to two ounces of water, forty minims of No. 1, and one dram of No. 2. In case of over exposure, add again a quarter to half a dram of No. 2, and also a grain of bromide of potassium. For under exposure add No. 2 without the bromide.

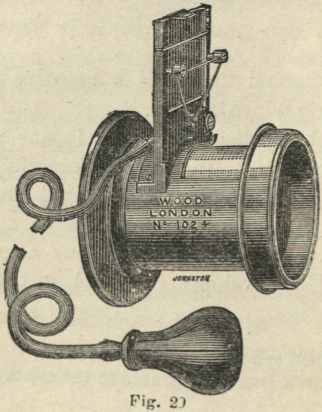


Fig. 20

Wood's new instantaneous shutter, "The Waterloo," is a compact contrivance which can be fitted to any lens. Its speed can be varied by the simple adjustment of an india-rubber band. The shutter works within the diaphragm slot of the lens, which is the place where a shutter should work. (See Fig. 33.)

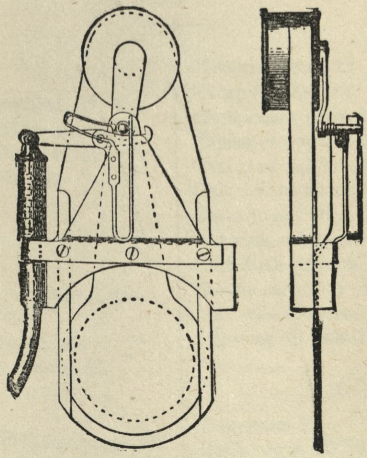
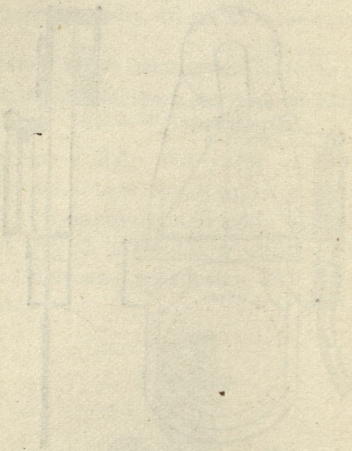


Fig. 30.

Another shutter which also works in the slot of the lens is the "Grimston." (See Fig. 34.) In both these cases the mechanism is actuated by a pneumatic release—that is to say, the pressure of an india-rubber ball sends a puff of air through an attached tube, which moves a small piston in a cylinder. This pneumatic release is now employed on most forms of shutter.



INDEX.

APPENDIX.

List of Dark Rooms available to Amateur Photographers.

Note.—The information given in the following pages has been mostly gleaned direct from the places named, but much of that relating to British hotels and inns has been reproduced from the excellent handbook of the Cyclists' Touring Club, by kind permission of the editor. The photographic accommodation afforded in these hotels is often of a very primitive kind, and will sometimes consist of a mere cupboard. The tourist will do well, therefore, to carry a folding red lamp with him in case of emergency.

It will be understood that, as a rule, the dark-rooms are *free* to AMATEURS, but occasionally a small fee is expected, and that hotel-keepers and photographic material dealers offer such accommodation (generally limited to the changing of plates) to their customers only. The rooms are available during business hours only, and where developing is done by the amateur, there is usually a charge of so much per hour, in addition to the cost of any chemicals consumed by the worker. The asterisk (*) against an entry signifies that dry plates may be purchased of the proprietor.

ENGLAND AND WALES.

Aberavon	Walnut Tree Hotel.
Abergavenny	Swan Hotel.
Accrington	Hargreaves Arms Hotel.
Alford	White Horse Hotel.
Alnwick	Star Hotel, Fenkle Street.
Ambleside	Waterhead Hotel.
Arley, Upper	Valentia Arms.
Ashbourn	Green Man Hotel.

Ashburton	Golden Lion Hotel.
Ashby-de-la-Zouch	Queen's Head Hotel.
Ashford	George Hotel, 23, Bank Street.
Atherstone	White Hart Hotel.
Axbridge	Lamb Hotel.
Bakewell	Castle Hotel; — Housley, Matlock Street.
Bangor	Castle Hotel, High Street.
Barmouth	Barmouth Hotel.
Barnet	Elliot and Son, Park Road.*
Barrow-in-Furness	Imperial Hotel.
Bath	White Lion Hotel; Bath Photo. Society, Literary Institution, Terrace Walks; M. Ashman, 12A, Old Bond Street.*
Beccles	King's Head, Market Place.
Berwick	Red Lion Hotel, High Street.
Bethesda	Douglas Arms Hotel.
Bettws-y-Coed	Glan Aber Hotel.
Bideford	Royal Hotel.
Birmingham	S. Hulme, Exchange Buildings, New Street.*
Bishops Waltham	Crown Hotel.
Bishops Stortford	George Hotel; Feathers Hotel.
Blackburn	Photo. Society, Royal Chambers, Victoria Street (Key at 17, Northgate); Photo. Society, 33, Victoria Street (Free on presentation of card).
Blackpool	Victoria Hotel.
Blaenau (Festiniog)	Queen's Head Hotel.
Bolton	Saddle Hotel, Bradshawgate; W. Banks, 32, Corporation Street.*
Boroughbridge	Grantham Arms Hotel.
Bournemouth	J. Hardwick, 21, Commercial Road;* Dale's, Westbourne.*
Bournemouth (West)	Branksome Hotel, Commercial Road.
Bradford	Alexandra Hotel; J. Walker, 22, Charles Street;* Appleton and Co., 58, Manningham Lane.*
Brading (I. of W.)	Red Lion Hotel.
Braintree	White Hart Hotel.
Bridge	Red Lion Hotel.
Bridgnorth	Crown Hotel, High Street; Swan Hotel, High Street.
Bridlington Quay	Brunswick Hotel.
Brigg	Angel Hotel.
Brighouse	Royal Hotel.
Brighton	Hardcastle, 71, East Street;* Photo. Society, 40B, King's Road Arches (apply to Secretary by letter only); Gloucester Hotel, London Road; Castle Hotel, Middle Street.
Brighton (West)	C. H. Lewis, 60, Lansdowne Street, Hove.*
Bristol	M. W. Dunscombe, 10, St. Augustine's Parade;* H. Husbands, 8, St. Augustine's Parade;* J. Epstein, 33, Broad Street; W. T. Whetter, Villiers Road;* Royal Talbot Hotel, Victoria Street.
Brixham	Bolton Hotel.

Broadway (Worc.)	Lygon Arms Hotel.
Brockenhurst	Rose and Crown Hotel.
Bromyard	Hop Pole Hotel, Market Square; Falcon Hotel, High Street.
Brough	Castle Hotel.
Burnham-on-Sea	White Hart Hotel.
Burnley	Bull Hotel; Cronkshaw's Hotel, Grimshaw Street; Amateur Photo. Society, Bank Chambers, Hargreaves Street (Key at 48, Manchester Road); J. W. Wright, 141, St. James's Street.*
Burton	Queen's Hotel, Bridge Street.
Bury	White Horse Hotel.
Calne	Lansdowne Arms.
Cannock	Crown Hotel.
Canterbury	Falstaff Hotel.
Capel Curig	Tan-y-Bwlch Hotel.
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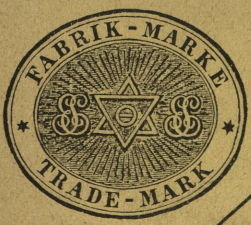

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